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NUCLEAR SCIENCE ABSTRACTS

Volume 13 Number 8 April 30, 1959

GENERAL

5193 A/CONF.15/P/801
Isomet Corp., Palisades Park, N. J.
NEW HORIZONS FOR STABLE ISOTOPES. I. W. Ruderman. 9p. $0.50(OTS).

Prepared for the Second U. N. International Conference on the Peaceful Uses of Atomic Energy, 1958.

Recent improvements in methods of stable isotope separation are summarized. Applications of nuclear magnetic resonance, ultracentrifuge techniques, and emission spectroscopy for isotopic analysis are discussed. Recent applications of the stable isotopes of lithium, boron, carbon, nitrogen, and oxygen as tracers in studies in the fields of agronomy, biology, chemistry, medicine, physics, and nuclear engineering are summarized. 34 references. (C.H.)

5194 A/CONF.15/P/2179
California. Univ., Livermore. Radiation Lab.
NON-MILITARY USES OF NUCLEAR EXPLOSIONS. H. Brown and G. W. Johnson. 15p. (UCRL-5026). $0.50(OTS).

Prepared for the Second U. N. International Conference on the Peaceful Uses of Atomic Energy, 1958.

The problems connected with the utilization of nuclear and thermonuclear explosions fall into several general categories which are interrelated. Problems discussed include choice of project, technical feasibility, and economic feasibility. Applications to excavation, heat production and storage, and isotope production are discussed. Data from the underground Rainier Burst are given. (W.D.M.)

5195 A/CONF.15/P/2457
[Columbia Univ., New York].
THE ROLE OF ATOMIC ENERGY IN THE PROMOTION OF INTERNATIONAL COLLABORATION. I. I. Rabi. 3p. $0.50(OTS).

Prepared for the Second U. N. International Conference on the Peaceful Uses of Atomic Energy, 1958.

A brief survey is presented of the international cooperation which made a success of the First Geneva Conference and which has initiated many international scientific meetings since that time. The policy of the United States in this respect is discussed. (J.S.R.)

5196 ITR-1474
Holmes and Narver, Inc., Los Angeles.
TEST OF BURIED STRUCTURAL-PLATE PIPES SUBJECTED TO BLAST LOADING. Preliminary Report. R. A. Williamson. Nov. 1958. 44p. Project 34.3 [of] OPERATION PLUMBBOB. $1.25(OTS).

Two 20-foot-long, 7-foot-diameter, 10-gauge structural-plate pipes having longitudinal joints with 8 bolts per foot were buried and tested in the Smoky event of Operation Plumbbob at nominal predicted pressure levels of 195 and 265 psi and at measured pressure levels of approximately 170 and 195 psi. Depth of burial was 10 feet. The data obtained are to be used primarily in evaluating the suitability of structural-plate pipe as a partial substitute for heavy-concrete tunnel sections in the construction of scientific stations at ranges close to nuclear detonations. In view of the typical soil conditions of the Nevada Test Site, however, the results may not be applicable to other locations. Principal measurements taken of each pipe included the transient changes in horizontal and vertical diameters vs time, vertical and radial accelerations of the pipe invert, and the maximum interior overpressure. Supplementary data included preshot and postshot measurements of horizontal and vertical diameters, joint slip, distances between end bulkheads, and elevations of the ground surface. Soil properties obtained included density, percentage of compaction, gradation, and the coefficient of internal friction. Maximum transient changes in vertical and horizontal diameters measured by the self-recording gauges were about $\frac{7}{8}$ inch and $\frac{3}{8}$ inch, respectively. Maximum residual changes in the same diameters were about $\frac{3}{4}$ inch and $\frac{1}{4}$ inch, respectively. Discrepancies were found between measurements of residual changes recorded by the gauges and those obtained visually before and after the event. Slip in bolted joints was negligible. (auth)

5197
DISTRIBUTION OF ARTIFICIAL RADIOACTIVITY IN DUST SAMPLES AND RAIN WATER RESIDUES.
R. May and H. Schneider (Univ. of Giessen, Ger.). Atomkernenergie 4, 28-9(1959) Jan. (In German)

The distribution of the artificially induced radioactivity of dust and rain water residues was investigated. It was found that in many cases only a few dust particles are responsible for carrying the activity, while most of them are practically inactive. From dust sedimented within two days, particles carrying radioactivity stemming from different atomic tests could be differentiated. The γ-spectra analysis of these particles shows different emitter composition. (auth)

5198
THE CONSUMPTION OF URANIUM UP TO 1970. PRINCIPAL PROSPECTS IN THE WESTERN WORLD.

M. Waynbaum. Bull. inform. sci et tech. No. 13, 2-11 (1958) Jan. (In French)

The needs of the western world for uranium up to 1970 are reviewed. The examination is based on the nuclear electrification programs of Euratom, Great Britain, and the United States, the most industrialized nations and those most advanced in nuclear technology. The military needs, development of nuclear propulsion for ships, and research needs are also considered in the calculations. The characteristics of reactors in the present stage of development and their development from 1960 to 1970 are reviewed with respect to the fuel requirements. It is estimated that by 1970 50,000 tons of uranium will be needed per year, of which 80% will be used for the electrification program. (J.S.R.)

5199

ATTI DEL CONGRESSO SCIENTIFICO. VOLUME I. SEZIONE NUCLEARE, GIUGNO 1957. 4ª RASSEGNA INTERNAZIONALE ELETTRONICA E NUCLEARE. (Acta of the Scientific Conference. Volume I. Nuclear Section, June 1957. 4th International Electronic and Nuclear Review.) Rome, Segret, Comitato Nazionale delle Ricerche Nucleari, [1958]. 573p.

The papers given at the 4th International Electronic and Nuclear Review are presented. The topics discussed include the problem of nuclear energy in Italy and in Europe, uranium and thorium metallurgy, applications of nuclear energy to agriculture and biology, and applications of nuclear energy to medicine. (J.S.R.)

5200

INTERNATIONAL COLLABORATION. Basilio Focaccia. pp. 21-31 in "Atti del Congresso Scientifico. Volume I. Sezione Nucleare, Giugno 1957." (In Italian)

The utilization of nuclear energy presents many complex problems, and the development of international collaboration is necessary for their solution. The growth of international organizations whose purpose is coöperation in the establishment of atomic energy utilization is discussed with emphasis on EURATOM. (J.S.R.)

5201

THE ENERGY NEEDS AND THE FUNCTION OF NUCLEAR ENERGY. Francesco Giordani. pp. 33-50 in "Atti del Congresso Scientifico. Volume I. Sezione Nucleare, Giugno 1957." (In Italian)

A survey is made of the energy needs of Europe at present and of the probable increase in its requirements. The deficit between the energy needs at present and the available resources is discussed and extrapolated to the future. The cost of increasing the petroleum production of the world is discussed and compared to the cost of nuclear power stations. (J.S.R.)

5202

NEEDS AND RESOURCES OF URANIUM AND THORIUM. Felice Ippolito. pp. 51-71 in "Atti del Congresso Scientifico. Volume I. Sezione Nucleare, Giugno 1957." (In Italian)

The energy requirements of the world, of Europe, and of Italy are briefly discussed. The principal centers for the production of uranium at present are localized in the United States, Canada, Soviet Union, South Africa, and Australia. The requirements for uranium are compared with the present and future production for several countries. The status of geological investigations in Italy for the discovery and evaluation of uranium and thorium deposits is discussed. (J.S.R.)

5203

INDUSTRIAL PLANS FOR THE DEVELOPMENT OF A NUCLEAR INDUSTRY IN ITALY. Gino Martinoli. pp. 73-93 in "Atti del Congresso Scientifico. Volume I. Sezione Nucleare, Giugno 1957." (In Italian)

A project for the development of nuclear power plants in Italy is proposed. The total investment for such a project and the cost/kwh are discussed. The national resources of nuclear fuel at the present stage of discovery and development are insufficient for the program; however, uranium is available on the whole market. The contribution of the Italian industry to the nuclear program is considered. The problem of personnel is discussed. The load distribution from various types of electric power plants is discussed and extrapolated to 1975. (J.S.R.)

5204

NEW INCREASES OF PRODUCTIVITY BY NUCLEAR ENERGY. Jacques Errera. pp. 139-162 in "Atti del Congresso Scientifico. Volume I. Sezione Nucleare, Giugno 1957." (In French)

Economic changes caused by the industrial application of nuclear energy are briefly surveyed. Military applications, production of electric power, utilization of radioisotopes in industry, and agricultural applications are reviewed. (J.S.R.)

5205

FUNDAMENTAL RESEARCH AND THE TRAINING OF PERSONNEL. Edoardo Amaldi. pp. 219-36 in "Atti del Congresso Scientifico. Volume I. Sezione Nucleare, Giugno 1957." (In Italian)

The basic research being conducted in Italy includes the fields of low- and high-energy nuclear physics, cosmic radiation, physics and engineering of particle accelerators, and plasma physics. The technical personnel needed to continue these investigations are estimated. Possible methods for the development of the scientists and engineers are briefly indicated. (J.S.R.)

5206

HANDBOOK OF THE ATOMIC ENERGY INDUSTRY. S. Jefferson, ed. London, George Newnes Limited, 1958. 256p.

Information is presented on the atomic energy industry under the following topics: atomic energy authorities throughout the world; education and training within the United Kingdom Atomic Energy Authority; the development of nuclear energy; atomic structure; nuclear fuels; nuclear reactors; nuclear power for aircraft and marine propulsion; basic reactor physics; metals of interest in atomic energy; moderator and reflector materials; accelerators; radioisotopes; use of radioisotopes and their radiations in industry; medical, biological and agricultural uses of radiation and radioactive isotopes; radiation hazards and protection; radiation detectors; handling of radioactive isotopes; and radioactive waste disposal. (J.H.M.)

BIOLOGY AND MEDICINE

5207 A/CONF.15/P/878

Boston Univ. School of Medicine; Veterans Administration Hospital, Boston; and Massachusetts Memorial Hospitals. Robert Dawson Evans Memorial, Boston.

TOTAL AND PARTIAL BODY RADIOACTIVITY MEASUREMENTS FOR METABOLIC TRACER STUDIES. G. J. Hine and B. A. Burrows. 8p. $0.50(OTS).

Prepared for the Second U. N. International Conference on the Peaceful Uses of Atomic Energy, 1958.

By counting the radioactivity from an injected tracer dose in the patient's body, head, and foot, the exchange rates between different body compartments can be estimated. This method gives more information than can be obtained from serum samples and urine collections alone. The rapid changes occurring during the first few hours after the administration of the tracer dose can be followed in detail. Certain differences of the exchange rates in normal subjects and patients with essential hypertension become apparent from the head radiosodium measurements. Since the observations during the first two hours seem to be of particular value, the measurements can be repeated within a few days interval to investigate the effect of therapy on these exchange rates. Data are included from studies employing sodium-24 and potassium-42. (C.H.)

5208 A/CONF.15/P/2397
Rochester, N. Y. Univ.
ON THE MECHANISM OF SKELETAL FIXATION OF RADIOSTRONTIUM. W. F. Neuman. 7p. $0.50(OTS).

Prepared for the Second U. N. International Conference on the Peaceful Uses of Atomic Energy, 1958.

The mechanisms underlying the skeletal fixation of strontium were investigated under equilibrium conditions in vitro. A synthetic hydroxy apatite preparation, the prototype of bone mineral, and a stable solution of strontium-90 were used. The effect of calcium ion concentration on the incorporation of strontium by the hydroxy apatite crystals, the reversibility of the exchange reaction, and intracrystalline exchange were also investigated. A provisional description of the mechanism underlying the skeletal fixation of strontium is presented. The findings indicate that therapeutic procedures, such as the administration of chelating agents, for the reduction of a skeletal burden of radiostrontium are likely to be unsuccessful. (C.H.)

5209 A/CONF.15/P/2530
Brookhaven National Lab., Upton, N. Y.
COOPERATIVE STUDIES ON RADIATION INDUCED MUTATIONS IN PLANTS. Howard J. Curtis. 8p. (BNL-3883). $0.50(OTS).

Prepared for the Second U. N. International Conference on the Peaceful Uses of Atomic Energy, 1958.

Three methods are used to induce mutations in plants: irradiation of trees or shrubs to produce whole-branch mutations which can be propagated asexually, and the irradiation of pollen, which can then be used for pollination. Seed treatment is the plan which has had the greatest success, and it is discussed in some detail. It appears that neutron irradiation produces more mutations than x radiation. The production of somatic mutations in trees and shrubs is less well developed, but some mutations were developed on peach trees grown in the Brookhaven gamma field. Very little work has been done on irradiation of pollen. (J.S.R.)

5210 AD-108849
Chicago. Univ. Air Force Radiation Lab.
RADIATION AND SUSCEPTIBILITY TO INFECTION. (A Literature Survey). Robert D. Boche. 1954. 67p. Contract AF33(038)-27353.

A survey was made of the literature on the relationship between immune processes and radiation exposure. Topics discussed in detail include the invasion of the irradiated animal by bacteria normally present in the environment or gastrointestinal tract, the influence of irradiation on susceptibility to infection by organisms introduced from outside, the effect of various doses of radiation on immunity, reaction mechanisms involved in the susceptibility of irradiated animals to infection, the response to antibiotic treatment of infections associated with radiation injuries, and the relationship between exposure time and the introduction of antigen or infective agent on the processes of immunity and susceptibility in irradiated animals. 269 references. (C.H.)

5211 AD-149988
Stanford Research Inst., Menlo Park, Calif.
COMPARATIVE STUDY OF THE EFFECTS OF HIGH AND LOW INTENSITY RADIATIONS IN FOOD STERILIZATION. Report No. 9 (Final) [for] June 1, 1955—August 31, 1957. S. I. Taimuty and R. E. De LaRue, Jr. Sept. 17, 1957. 60p. Contract DA19-129-QM-429.

The comparative effects of high- and low-intensity radiation were studied on organolepic changes in foods, bactericidal efficiency, and nutrient destruction. A cobalt-60 gamma source was used for the low-intensity irradiations, and a 6- to 9-Mev linear electron accelerator was used for the high-intensity irradiations. Data are tabulated on powdered milk, strawberries, white bread, fresh peas, fresh stringbeans, shrimp, sirloin steak, ground round steak, smoked ham, bacon, A. aerogenes and B. subtilis suspended in nutrient broth and in human plasma, aqueous solutions of ascorbic acid, riboflavin, and mixed amino acids, vitamin A acetate in isopropyl alcohol, and albumin and globulins from human plasma. Results lead to the conclusion that effects due to type of radiation and rate of irradiation do not play an important role in the effects of radiation on foods, bacteria, and nutrients. (C.H.)

5212 AD-154836
Midwest Research Inst., Kansas City, Mo.
STUDY OF CHEMICAL ADDITIVES FOR FOODS TO PREVENT DAMAGE DURING RADIATION STERILIZATION. Report No. 14 (Final) [for] June 24, 1955—July 23, 1957. R. W. Shortridge. 42p. Project No. 7-84-01-002. Contract DA19-129-QM-472.

Results are summarized from a study of the effects of 55 chemicals added to foods prior to their irradiation in preventing or minimizing the off-flavor induced by radiation. Nineteen of the additives were tested further for their effects on hamburger, haddock, corn, and lima beans. The foods were taste-tested after cooking as appetizingly as possible. None of the additives tested gave any significant protection against development of irradiation off-flavor. (C.H.)

5213 AD-161549
Quaker Oats Co. Research Labs., Barrington, Ill.
EVALUATION OF THE CHANGES IN OATS RESULTING FROM EXPOSURE TO IONIZING RADIATION. Report No. 8 (Annual) [for] January 1, 1957—December 31, 1957. E. F. Caldwell. 12p. Project No. 7-84-01-002.

Dried oat groats were irradiated at a dose level of approximately 0.9 megarads by gamma and by electron radiation. Cobalt dosimeter glasses were used to check the radiation dose actually received. The oats were taste-tested by being rolled and made into oatmeal cookies. A panel of 36 people judged the samples using the hedonic rating scale, and vitamin and amino acid assays were made. No appreciable differences in taste, storage stability, or nutritional value due to either type of irradiation could be found under the conditions used. Prebaked pancakes in polyethylene-Mylar envelopes were similarly irradiated. Initial taste tests of irradiated

samples showed slight darkening, slight off-flavor, and gummy texture but none was deemed unacceptable. Marked deterioration occurred upon storage either frozen or at room temperature. Bacterial decomposition became evident in some samples after 2 weeks at room temperature, but other deteriorative changes took place even in frozen storage. No great differences between electrons and gamma rays were observed in these respects. (auth)

5214 AD-161585
Vanderbilt Univ., Nashville. School of Medicine.
LONG-TERM MONKEY FEEDING EXPERIMENT ON IRRADIATED PEACHES, WHOLE ORANGES AND PEELED ORANGES. Progress Report No. 1 [for] February 1, 1957 to April 14, 1958. Frank R. Blood, William J. Darby, Richard C. Dybdahl, Carl E. Miller, Robert J. Dilworth, Donald B. Rogers, and Matthew Wright. 16p. Contract DA-49-007-MD-779.

No effects due to irradiated foods were observed in monkeys maintained for 12 weeks on a diet containing irradiated peaches and oranges. (C.H.)

5215 AD-161955
Baylor Univ., Houston, Tex. Coll. of Medicine and Jefferson Davis Hospital, Houston, Tex.
A STUDY OF THE EFFECTS OF TOTAL AND PARTIAL BODY RADIATION ON IRON METABOLISM AND HEMATOPOIESIS. Progress Report for Period September 1, 1957 to February 28, 1958. V. P. Collins, C. T. Teng, W. R. Karn, and W. D. West. Mar. 13, 1958. 57p. Contract DA-49-007-MD-428.

Procedures are described which were used in the calibration of a 2-Mev Van de Graaff generator and in radiation dosage determinations. Data are tabulated from tracer studies using iron-59 labeled serum iron to determine the effect of radiation on erythropoiesis in human patients with cancer or various hematologic disorders. The intensive irradiation of blood in extra-corporeal, circulation induced an initial depression of white blood cell count followed by an elevation which persisted for several weeks. When plasma from the treated dogs was administered intravenously to normal dogs, an initial depression was followed by a sustained rise in values for hemoglobin, red count, and white count. Autotransfusion with 500 cc of irradiated whole blood resulted in a temporary rise in values for hemoglobin, red cell, and white cell count in a cancer patient with microcytic anemia. An investigation was started of the lethal radiation dose for dogs. Observations were made on patients receiving whole-body irradiation in an effort to establish a relationship between individual radiosensitivity and the presence of concomitant disease. (C.H.)

5216 AD-162964
Medical Coll. of Virginia, Richmond.
LONG-TERM DOG FEEDING TESTS ON IRRADIATED GREEN BEANS AND FRUIT COMPOTE. Progress Report No. 2 [for] September 2, 1957 to March 10, 1958. Paul S. Larson, H. B. Haag, J. K. Finnegan, R. Blackwell Smith, Jr., Gordon R. Hennigar, and Lester F. Belter. 16p. Contract DA-49-007-MD-786.

No adverse effects were noted in dogs maintained for 26 weeks on a diet containing irradiated green beans and fruit compote. Data are tabulated on growth, feed efficiency, and blood picture of the test animals. (C.H.)

5217 AD-200438
Vanderbilt Univ., Nashville. School of Medicine.
LONG-TERM RAT FEEDING EXPERIMENT ON IRRADIATED BEEF. Progress Report No. 1 [for] February 1, 1957 to June 3, 1958. Frank R. Blood. 18p. Contract DA-49-007-MD-779.

No effects due to toxicity of irradiated foods were noted in rats fed irradiated beef over a twelve-week period. (C.H.)

5218 AD-200439
Vanderbilt Univ., Nashville. School of Medicine.
LONG-TERM DOG FEEDING EXPERIMENT ON IRRADIATED CHICKEN, BEEF AND JAM. Progress Report No. 2-A [for] March 17, 1958 to June 13, 1958. Frank R. Blood. 14p. Contract DA-49-007-MD-779.

Results are reported from observations during the 24th week of a long-term feeding experiment of irradiated chicken, beef, and jam to dogs to determine the wholesomeness of irradiated food stored six months at room temperature. Hematologic examinations showed normal values for all dogs. Results of urine analysis were normal for dogs on chicken or beef, while those on the jam diet showed glycosuria. No effects directly related to the toxicity of the irradiated foods were noted in any of the animals. (C.H.)

5219 AD-201834
Indiana. Agricultural Experiment Station, Lafayette.
A STUDY OF THE FEASIBILITY OF UTILIZING IONIZING RADIATION TO INCREASE THE STORAGE LIFE OF POTATOES. Progress Report No. 8 [for] January 1, 1958–February 28, 1958. N. K. Ellis. 6p. Project No. 7-84-01-002. Contract DA-19-129-QM-789.

Potatoes harvested in the fall of 1956 and irradiated at levels from 0.0 to 15.0 kilo-reps were stored at 41°F. Nonirradiated check tubers of all varieties sprouted and underwent some shriveling. Irradiated tubers of the varieties Sebago, Red Pontiac, and Katahdin, with no sprouts, also shriveled to various degrees, whereas identically treated Russet Burbanks are still quite turgid. Loss of moisture from the potatoes stored at 41°F was determined by periodic weighings. Data on the accumulative percentages of weight lost 380 days after the potatoes were first weighed into the experiment are tabulated. Results from limited cooking tests are included. (C.H.)

5220 AD-202042
Pillsbury Mills, Inc., Minneapolis.
INVESTIGATION AS TO THE MERITS OF IRRADIATION IN INCREASING THE SHELF LIFE OF CEREAL PRODUCTS AT LOW OR HIGH MOISTURE LEVELS. Report No. 8 (Annual) [for] January 1–December 31, 1957. Howard E. Bauman. 11p. Project No. 7-84-01-002.

Results are reported from an experiment designed to determine the effects of irradiation on individual cake mix ingredients. The results indicate that the irradiation of flour with dosages as low as 0.047×10^6 rads causes an appreciable reduction in its cake baking quality. This treatment also produced darkening of the baked cake. Higher levels of irradiation produced progressively more deterioration in cake quality. It was also shown that irradiated sugar produces cakes which are dark in color. The darkening is directly proportional to the dosage. The irradiation of albumen causes a reduction in its cake baking quality. Loss in resiliency and volume was noted when irradiated albumen was used in layer cake mixes. The irradiation of shortening also produced a slight reduction in cake baking quality. (auth)

5221 AD-202181
Illinois. Univ., Urbana. Coll. of Veterinary Medicine and Illinois. Agricultural Experiment Station, Urbana.
TO DETERMINE THE EFFECT OF IRRADIATION UPON

THE WHOLESOMENESS OF FOOD. Progress Report No. 5 [for] September 1957—February 1958. Elwood F. Reber, Julius P. Kreier, Om P. Malhotra, and H. W. Norton. 9p. Contract DA-49-007-MD-72800.

Nonirradiated beef and beef irradiated at 2.79 and 5.58 megarads was fed to dogs for 24 weeks. When the weight gained by the dogs was or was not adjusted for differences in initial weights, there was no significant difference due to treatment. There was a significant decrease in food consumption of 995 gm per megarep of irradiation when food consumption was adjusted for variations in the initial weights of the dogs. The results of the studies of the blood of the dogs fed irradiated beef did not differ from those of the dogs fed nonirradiated beef. Irradiation of flour increased the hot-paste viscosity of the samples tested. Nonirradiated flour and flour irradiated at 37,200 and 74,400 rads was fed to dogs for 24 weeks. There was no significant difference in weight gained nor in food efficiency due to treatment. The results of the studies of the blood of the dogs fed irradiated flour did not differ from those of the dogs fed nonirradiated flour. (auth)

5222 AECU-3965

Bjorksten Research Foundation, Madison, Wis.

FUNDAMENTALS OF AGING. INSOLUBILIZATION OF PROTEIN AS A FUNCTION OF AGING. Quarterly Report No. 3 [for] October 1, 1958—December 31, 1958. Johan Bjorksten, Fred A. Andrews, Julia Bailey, and Bruce Trenk. 9p. Contract AT(11-1)-606. $1.80(ph OTS); $1.80(mf OTS).

Two groups of experimental white rats were x-irradiated at weekly intervals. One group received a total dose of 1500 r over twenty weeks with a total survival rate of 95% at the end of the succeeding thirty days. The second group of animals received a total of 2850 r in nineteen weeks. In the latter group only 15% of the animals survived an additional thirty days. Organs from both young and old controls and from x-irradiated animals were microincinerated and compared. Results of the microincineration technique indicate that x-irradiated spleen contains higher than normal amounts of ash, most notably iron. Sections of spleen from the x-irradiated animals stained by conventional methods suggest that this group has developed myeloid leukemia. Tail tendons from both young and x-irradiated rats were used for the determination of shrinkage temperature. The tendons from both groups of animals shrank at close to 60°C, but the physical behavior of the x-irradiated tendons was markedly different from the control group. The x-irradiated tendons did not shrink as sharply as the controls, and the tendons were much weaker. (auth)

5223 AECU-3983

Minnesota. Univ., Minneapolis. Medical School.

EFFECT OF IONIZING RADIATION ON ELECTROLYTE AND WATER METABOLISM. Final Report for the Period July 1, 1950 to October 31, 1958. 116p. Contract AT(11-1)-106. $18.30(ph OTS); $6.00(mf OTS).

Data are presented from a comprehensive study of the effects of ionizing radiation on electrolyte and water metabolism in rats. The data indicate that there is a prompt loss of sodium and potassium after irradiation, but the chloride balance does not become negative until the fourth day after irradiation. Direct tissue analysis procedures were used to check the validity of the results and aid in their interpretation. Data are included on alterations in plasma, interstitial, and extracellular fluid volumes in irradiated animals, the concentrations of sodium and potassium in certain tissues, and the effects related to the action of desoxycorticosterone and other hormones of the adrenal gland in salt and water metabolism. 58 references. (C.H.)

5224 AFSWP-962

Baylor Univ., Houston, Tex. Coll. of Medicine.

THE INFLUENCE OF TOTAL BODY X-RAYS ON THE KINETICS OF ERYTHROCYTE ENZYMES AS A BIOLOGICAL DOSIMETER. Progress Report III [for] June 1, 1957 to May 31, 1958. Donald A. Rappoport. 38p. Contract DA-49-007-MD-428.

The enzymes responsible for phosphate esterification in rat erythrocytes are found only in the soluble fraction; the stroma is inactive. Addition of DPN, TPN, and TPP to dialyzed erythrocyte preparations did enhanced phosphate esterification. The presence of nicotinamide during lysis and dialysis of the hemolysates enhanced ester formation by inhibiting the activity of DPN-ase and TPN-ase. Deoxyguanosine and deoxyadenosine were substrates for phosphate esterification, similar to the ribosides, and yielded C-3, C-5, and C-6 phosphate esters. Erythrocyte supernatant fractions from rats treated with 1000 r total-body x rays showed increased ester formation 24 hours after irradiation and a decreased activity in 72 and 168 hours postirradiation. Tentative indications are that longer incubation intervals reflect a greater difference in ester formation between controls and irradiated hemolysates than shorter incubation periods. (auth)

5225 NM-62-02-00.01.02

Naval Radiological Defense Lab., San Francisco; Naval Medical Research Inst., Bethesda, Md.; and Brookhaven National Lab., Upton, N. Y.

THE EFFECT OF EXPOSURE GEOMETRY AND BEAM SPECTRUM ON DEPTH-DOSE PATTERNS FOR PENETRATING IONIZING RADIATION IN LARGE MAMMALS AND MAN. V. P. Bond, E. P. Cronkite, C. A. Sondhaus, G. W. Imirie, J. S. Robertson, and D. C. Borg. Nov. 9, 1956. 26p. (AD-200455).

Presented as part of a symposium at the Radiation Society Meetings, Chicago, Illinois, May 17 to 19, 1956.

Geometrical considerations and measured depth-dose patterns for a phantom approximating the size of man are presented for a variety of exposure conditions including unilateral, bilateral, multilateral, cross fire, rotational, and 4π techniques; initial gamma radiation from nuclear bombs, and gamma radiation from radioactive fallout. Since monitored readings as well as calculations for nuclear effects involve of necessity the air dose, and most large-animal radiobiological data are reported similarly, tissue doses in the phantom are given here in terms of the entrance dose as measured in free air. The marked difference in dose absorbed in tissue for a given air dose, as usually expressed, is pointed out, as are the marked differences in the degree of homogeneity of dose through the tissues, under the various geometries considered. Available large-animal lethality data are tabulated, and the widely-varying degrees of effect noted for the same air dose, under the several conditions used, are compared with those predicted from geometrical considerations. Expressing the degree of exposure as midline tissue dose, instead of entrance air dose, results in a better correlation of dose and effect for some, but not all of the geometrical situations considered. The integrated tissue dose expressed as gram-roentgens is shown to be an unsatisfactory concept for the correlation of biological data for the different geometrical situations discussed. The

additional complicating factors of beam energy and spectrum on the determination of the biological effect are discussed. 41 references. (auth)

5226 NM-62-02-00.02.01

Naval Medical Research Inst., Bethesda, Md. and National Cancer Inst., Bethesda, Md.

EFFECT OF TOTAL-BODY X-RADIATION FROM NEAR THRESHOLD TO TISSUE-LETHAL DOSES ON THE SMALL BOWEL EPITHELIUM OF THE RAT. I. CHANGES IN MORPHOLOGY AND RATE OF CELL DIVISION IN RELATION TO TIME AND DOSE.

R. Bland Williams, Jr., Jane Nicolet Toal, Julius White, and Harry M. Carpenter. Jan. 23, 1958. 46p.

The mitotic time determined through the use of colchicine, of epithelial cells lining the crypts of the small bowel of control, male, Sprague-Dawley rats weighing 200 ± 25 grams, is about 45 minutes. The percent of cells in division is 2.5. The intermitotic time is approximately 30 hours. In normal animals, a constant total epithelial cell population divided equally between crypts and villi, and a constant rate of division in the crypts, would result in a complete turnover of the epithelium in approximately 60 hours. Following x irradiation differential effects upon epithelial cells in the crypts have been demonstrated which consist of an initial drop in mitotic activity, acute cell destruction, absortive mitotic recovery, prolongation of interphase, and final recovery with overshooting. Acute destruction and an abortive mitotic recovery are responses of cells presumed to be in late interphase at the time of irradiation. Acute cell death is characterized by vacuolization, rupture and fragmentation of the nucleus with the number of cells involved increasing with dose but decreasing in proportion to dose. The number of cells acutely destroyed appears to vary inversely with the number undergoing an abortive mitotic recovery. On the basis of graphical integrations the stem cells involved in these effects are estimated to occupy normally about 8 hours of the intermitotic period. Both acute destruction and an initial delay in division appear to be involved in the shapes of the abortive recovery curves. Overshooting in mitotic activity above control levels does not occur to a significant degree during the abortive recovery. Prolongation of interphase is attributed to stem cells presumed to be in early interphase at the time of irradiation. This prolongation of interphase continues to increase as the dose is raised. Recovery may be delayed for periods of time equivalent to several normal interphases. Final recovery appears to involve a decrease in the intermitotic time of surviving stem cells. This provides a mechanism for replacement of those stem cells that have been acutely destroyed, an explanation for the sustained overshoot in mitotic activity observed during recovery, and a restoration of the normal age relationships of epithelial cells lining the crypts and villi. During final recovery sustained overshooting of mitotic activity occurs and increases in magnitude up to doses of 450 r, while the number of cells undergoing acute destruction also increases. There is an increase in weight of the entire small intestine above control levels, the extent of which is directly related to the degree of overshooting in mitotic activity. As the dose of x rays increases above 450 r an increasing number of crypts fail to recover at all, thus reducing the total number of cells involved in the overshoot. Acute cell destruction and differentiation and death, in lieu of division, occur earlier and involve greater numbers of stem cells as the dose of x rays is increased. On the other hand, the abortive rise in mitotic activity and final sustained recovery occur later as the number of roentgens is increased. A tissue-lethal dose of radiation does not result in the acute destruction of the majority of cells involved in the continual replacement of the small bowel epithelium. However, a permanent inhibition of division occurs. After such doses the bulk of the stem cells undergo differentiation and survive for several days, the effect being somewhat analogous to sterilization. This action of x irradiation may be due to the complete destruction of some compound that stem cells in early interphase are synthesizing during their progress towards division. Lesser degrees of destruction lead to the dose dependent prolongation of interphase observed. These effects of x irradiation upon stem cells in the crypts of the small bowel epithelium are direct in the sense that they are not influenced by actions of irradiation upon the rest of the body. However, at the intracellular level these effects are indirect in that they may be altered by environmental changes such as anoxia. The vast majority of vegetative intermitotic or stem cells responsible for the regeneration of rapidly proliferating mammalian tissues are in some stage of interphase during irradiation. What happens to such cells is therefore more important in determining the time and degree of recovery than what happens to the relatively few stem cells that are in any phase of visible mitosis during irradiation. Effects upon the regulating tissues may, however, also affect the time of recovery of stem cells under humoral control. 29 references. (auth)

5227 NM-62-02-00.02.02

Naval Medical Research Inst., Bethesda, Md. and National Cancer Inst., Bethesda, Md.

EFFECT OF TOTAL-BODY X-RADIATION FROM NEAR THRESHOLD TO TISSUE-LETHAL DOSES ON THE SMALL BOWEL EPITHELIUM OF THE RAT. II. CHANGES IN NUCLEIC ACID AND PROTEIN SYNTHESIS IN RELATION TO CELL DIVISION. Jane Nicolet Toal, James C. Reid, R. Bland Williams, Jr., and Julius White. Jan. 24, 1958. 12p.

The initial blockage of mitosis produced by x radiation in the rat small bowel epithelium is not accompanied by a proportionate reduction in the rate of DNA synthesis. After very low doses of x rays there is little or no immediate effect on DNA synthesis. The drop encountered from 1 to 5 hours after higher doses is believed to be due to acute destruction of the cells involved in active synthesis. At doses of 2000 r the initial fall is much greater than 50 percent. Depending upon the dose of x rays administered DNA synthesis falls to a low level during or before the transient recovery of mitotic activity noted in the proximal postirradiation period. DNA synthesis resumes before final mitotic recovery from radiation injury begins. The length of the interval is dose-dependent. Final recovery is accompanied by an overshoot in the synthetic rate of DNA, PNA, and protein directly related to the time and extent of the overshoot in mitotic rate. Five hours after administration of glycine-N^{15} to rats intraperitoneally the concentration of isotope in guanine of PNA and DNA in the small intestine exceeds that of adenine in both normal animals and in those dosed at various times following whole-body x radiation. After irradiation the concentration of isotope in DNA purines is reduced relatively more than in those of PNA during periods of mitotic inhibition and is increased relatively more during final recovery. Within each type of nucleic acid the purine pairs exhibit essentially parallel changes in isotope concentration. The PNA pyrimidines acquire equal

isotope concentrations in normal animals, and rise in parallel fashion during periods of accelerated synthesis during recovery from x radiation. Very little if any inhibition of incorporation into PNA pyrimidines occurs at any stage after irradiation. A transient stimulation in protein synthesis occurs shortly after irradiation followed by a stimulation of greater magnitude during the period of final recovery which is relatively smaller than the enhancement of uptake in the nucleic acids during this period. Depression below normal levels does not occur even with tissue-lethal doses which sterilize but immediately destroy only a small proportion of the epithelial cells lining the crypts. The different classes of radiation effects observed are thought to have their origin in different classes of stem cells distinguishable by the position they occupy in the mitotic cycle. (auth)

5228 NP-7122

Brussels. Centre d'Étude de l'Énergie Nucléaire. NOUVELLES METHODES DE STERILISATION PAR LES RADIATIONS NUCLEAIRES. (New Methods of Sterilization by Nuclear Radiations.) M. De Proost. May 21, 1958. 27p.

A review is presented on radiation sterilization of food, with the following topics being considered: atomic structure, different ionizing radiations, radiation sources, units of radiation doses, chemical effects of radiation, effect of irradiation on microörganisms, modifications of different components of food products by radiation, irradiation of food products, packing problems, and economic aspects. (J.S.R.)

5229 UCRL-8475

California. Univ., Berkeley. Radiation Lab. RADIOBIOLOGICAL STUDIES ON YEAST (DISCUSSION). Robert K. Mortimer. Sept. 1958. 9p. Contract W-7405-eng-48. $1.80(ph OTS); $1.80(mf OTS).

Data are reviewed on the nature of radiation-induced damage in yeast and modifications in radiation damage induced by physico-chemical and biological means. (C.H.)

5230 USNRDL-TR-281

Naval Radiological Defense Lab., San Francisco. WEIGHT NITROGEN AND DNA CONTENT OF SMALL INTESTINE MUCOSA OF RATS EXPOSED TO X-RAYS. R. E. Kay and C. Entenman. Nov. 19, 1958. 29p.

The quantitative relationships between the changes in small intestine weight, mucosa weight, mucosa DNA, and nitrogen following exposure to x rays were investigated. It was found that these relationships depend upon the magnitude of the dose, time of observation, nutritional state of the rat, and number of doses administered. Thus, depending on the particular combination of these variables, different effects of x irradiation on mucosa weight, intestine weight, and mucosa DNA and nitrogen were observed. Weight changes in the small intestine always reflected the changes in mucosa weight; changes in mucosa nitrogen after a single x irradiation always paralleled the changes in mucosa weight, whereas the changes in mucosa DNA were not as closely related to the weight changes; changes in mucosa weight and nitrogen did not correlate well with the dose received, whereas DNA level approximated a linear relationship over the range 300 to 900 r; and there was a minimum level to which the mucosa weight DNA and nitrogen decreased following x irradiation. 27 references. (auth)

5231 NP-tr-206

CONTRIBUTIONS TO THE STUDY OF THE METABOLISM OF CAESIUM, STRONTIUM AND A MIXTURE OF BETA-EMITTERS IN COWS. A. V. Lebedinskii (Lebedinsky), ed. Translated from a publication of the Scientific Committee on Medical Radiology of the Ministry of Health, U.S.S.R., Moscow, 1956. 18p.

The tissue distribution and excretion were measured for cows following the ingestion of strontium-89-90, cesium-137, and a mixture of beta-emitting radioisotopes containing niobium-95, zirconium-95, ruthenium-106, cesium-137, strontium-89-90, and an aggregate of rare-earth elements. Data are tabulated. Results of the investigation serve to emphasize the hazards of any large-scale use of radioactive fertilizers containing cesium, strontium, or other easily absorbed isotopes, and the danger of keeping animals on pastures or waters which are contaminated with radioactive substances. (C.H.)

5232 NP-tr-207

SUMMARIES OF PAPERS PRESENTED AT THE CONFERENCE ON THE REMOTE CONSEQUENCES OF INJURIES CAUSED BY THE ACTION OF IONIZING RADIATION. F. G. Krotkov, A. V. Lebedinskii (Lebedinsky), and A. I. Ignatyev, eds. Translated from a publication of the State Medical Literature Press, Moscow, 1956. 74p.

Results are reviewed from recent studies on the delayed pathological changes which may develop as the result of exposure to ionizing radiation. Data are included from the following studies: effects of exposure to fast neutrons on hematopoiesis, reproductive function, and lens opacity as observed in dogs after 4 years and in rabbits after 1.5 years; changes in the blood picture in dogs 6 to 50 months after the ingestion of a mixture of fission products, polonium-210, uranium nitrate, and strontium-89; changes in the blood picture of dogs exposed to single doses of x radiation at doses ranging from 275 to 600 r; a comparative study of the changes in the blood picture in chronic radiation sickness caused by subcutaneous administration of polonium, radiothorium, and radon; the effects of small doses of radiothorium on the life-span, weight, blood picture, urine, and the state of protein and lipid metabolism in dogs; pathological changes observed microscopically in tissue samples from dogs, rabbits, and rats 5 to 46 months after the administration of uranium fission products; pathological changes observed in sections from the cortex, subcortex, pons varolli, and medulla oblongata from the brains of dogs at periods ranging from 8 months to 2 years 7 months after exposure to doses of x radiation ranging from 400 to 600 r; morphological changes in loose connective tissue induced by single doses of whole-body x radiation and by chronic radiation sickness induced by repeated exposure to small doses of fast neutrons and by the intravenous doses of strontium-90 and polonium-210; morphological changes in dogs and rats induced by injections of radiothorium; the pathological effects of the combined influence of quartz-containing dust and radon on rats; the pathological effects of cerium-144, ruthenium-106, strontium 89-90, and mixture of beta-emitting radioisotopes after single and chronic 100-day exposure of rats; the pathological effects of various doses of plutonium nitrate administered intraperitoneally; reaction mechanisms involved in the development of tumors at the site of introduction of radioactive substances; the dynamics of the formation and development of osteogenic sarcomas; the effects of x radiation, neutrons, and incorporated radioactive substances on the function of the gonads in dogs; the sexual development of pups of the first, second, and

third generation following the administration of uranium fission products in doses of one microcurie/gram; the effects of uranium fission products administered by mouth in doses of one microcurie/gram on hematopoiesis of the progeny born during the next year; the chronic effects of ingestion of small doses of strontium-90 daily for 30 months; the dynamics of changes in the peripheral blood and bone marrow in dogs following chronic exposure to low-level doses of radiation; and the chronic effects of small doses of uranium fission products administered by mouth to dogs and rats daily over a 6-month period on general condition, body weight, blood picture, and tissue distribution and excretion of the radioactive material. (C.H.)

5233

BIOCHEMISTRY OF MYOGLOBIN. VI. THE EFFECTS OF LOW DOSAGE GAMMA IRRADIATION ON BEEF MYOGLOBIN. C. Bernofsky, J. B. Fox, Jr., and B. S. Schweigert (American Meat Inst. Foundation, Chicago and Univ. of Chicago). Arch. Biochem. Biophys. 80, 9-21(1959) Jan.

Irradiation of aqueous extracts of beef oxymyoglobin causes the pigment to undergo a series of reactions whereby the oxymyoglobin is converted to metmyoglobin which in turn is changed to a red compound which is stable to further irradiation. The red compound produced by irradiation has been characterized spectrophotometrically, and appears to be distinct from oxymyoglobin and peroxymetmyoglobin. In crude extracts, the red compound undergoes a postirradiation transformation to oxymyoglobin when kept in the cold, whereas, at room temperature, there is a slow change to metmyoglobin. Both purified pigment preparations and extensively dialyzed extracts undergo the irradiation changes; however, the red compound formed during irradiation very rapidly changes to metmyoglobin after irradiation. Dialyzable factors have been obtained from crude extracts which stabilize the red compound after irradiation. (auth)

5234

ON THE MECHANISMS OF SKELETAL FIXATION OF STRONTIUM. PART I. G. E. Harrison, E. Lumsden, W. H. A. Raymond, and A. Sutton (Medical Research Council, Harwell, Eng.). PART II. J. Boyd, W. F. Newman, and H. C. Hodge (Univ. of Rochester, N. Y.). Arch. Biochem. Biophys. 80, 97-113(1959) Jan.

The interaction between strontium ion and bone mineral or its prototype, hydroxylapatite, has been investigated in model systems in vitro. The results established ion exchange as an important mechanism by which strontium enters the crystalline phase. This ion exchange mechanism has long been assumed as being primarily responsible for the deposition of strontium in the skeletons of living animals. Evidence was also obtained which suggests that the bone mineral prefers calcium ion to strontium ion and predicts that skeletal processes should discriminate against strontium in vivo. 40 references. (auth)

5235

THE FIRST CORTICAL PROLIFERATION OF UNDIFFERENTIATED GONAD IN THE CHICKEN EMBRYO STERILIZED WITH GAMMA RADIATION. Guglielmo Marin. Atti. acad. nazl. Lincei Rend. Classe sci. fis. mat. e nat. 23, 486-91(1957) Dec. (In Italian)

A study was made of the morphology of cells in the cortex of the gonads following exposure to sterilizing doses of gamma radiation. (J.S.R.)

5236

ELECTRON PARAMAGNETIC RESONANCE SPECTRA OF BIOLOGICAL OBJECTS. EFFECT OF DENATURATION ON THE E.P.R. SPECTRA OF IRRADIATED PROTEINS. L. A. Blyumenfel'd and E. A. Kalmanson (Biological Sciences Section, Academy of Sciences of the U.S.S.R., Moscow). Biophysics (USSR) (English Translation) 3, 81-5(1958).

The effect of prior thermal denaturation on the electron paramagnetic resonance spectra of irradiated dry preparations of oxyhemoglobin, pepsin, ichthyocol, and casein was studied. As a result of such denaturation, post-irradiation doublet splitting (the same as found with crystalline glycylglycine) is observed in the spectra. Denaturation increases the radiation-induced free radical concentrations by several hundred times. The observed effects are given a structural interpretation. (auth)

5237

ULTRA-VIOLET MICROSCOPY AND CYTOPHOTOMETRY OF NORMAL AND X-IRRADIATED BONE MARROWS. V. Ya. Brodskii and I. A. Suetina (Severtsov Inst. of Animal Morphology, Academy of Sciences of the U.S.S.R., Moscow). Biophysics (USSR) (English Translation) 3, 85-93(1958).

The changes induced by radiation in nucleic acid and nucleotide content of nuclei were studied in bone marrow cells from mice after exposure to 700 r x radiation. Visual studies were made on marrow smears. Characteristics noted included cell and nuclear shape and dimensions, intensity of cytoplasm, and nuclear staining using both basic and acid stains. Unstained cells or tissue sections were studied under the ultraviolet microscope, the images being produced by ultraviolet absorption of the cell materials. Reduced ultraviolet absorption was observed within a few minutes of irradiation, the effect growing stronger with the passage of time. Quantitative cytochemical analysis was made for nucleic acids and nucleotides in the irradiated cells. An analysis of results led to the conclusion that radiation damage to cells is probably related to disturbance in nucleic acid metabolism, which causes a decrease in nucleotide content, and not to reduction in amounts of nucleic acid. (C.H.)

5238

CELL PROTECTION BY FATTY MATERIALS AGAINST RADIATION DAMAGE. V. M. Alekseeva (Inst. of Biophysics, Academy of Sciences of the U.S.S.R., Moscow). Biophysics (USSR) (English Translation) 3, 94-100 (1958).

Lipid accumulation was observed to afford a protective effect against radiation injuries in Endomyces magnusii maintained in a modified Rider's culture media. If carbohydrate sources predominate in the medium, the organisms are fat rich, and if the nitrogen is high, they are fat poor. Fat-rich cells were found to oxidize substrates at about one-third of the rate shown by fat-poor ones. Fat-rich cells were found to be about 30% more radiostable than fat-poor ones. Irradiated cells metabolized their internal reserves less rapidly if rich in fat, anti-oxidants reduced the viability of irradiated cells by about 25%, and large fat and lipid reserves had a marked effect on intracellular oxidation rates. It was concluded that the radioprotection is linked with intracellular oxidation. (C.H.)

5239

AN UPPER OXYGEN LIMIT IN YEAST IRRADIATION LESIONS. K. D. Kalantarov (Lomonosov State Univ., Moscow). Biophysics (USSR) (English Translation) 3, 105-9(1958).

A maximum in the number of cell deaths after lesions caused by the irradiation of yeast cells depends on the O_2 concentration. Increase in oxygen pressure after the maximum has been reached leads to a lowering of the percentage of affected cells. The maximum is seen at an oxygen partial pressure of 300 mm Hg. This phenomenon is similar in nature to that of the upper oxygen limit which is well recognized in physical chemistry. The phenomenon of an upper oxygen limit expressed as a maximum of cell deaths, with a subsequent decrease in the percentage of dead cells, is only seen in cells whose death has been considerably delayed. The effect could not be demonstrated in cells which were killed during the irradiation or died a short time after it. (auth)

5240

DISTURBANCES IN RETINAL FUNCTION CAUSED BY WEAK IRRADIATION. Ts. M. Avakyan (Inst. of Physiology, Armenian Academy of Sciences, Erevan). Biophysics (USSR) (English Translation) 3, 109-12(1958).

The electroretinogram was recorded before and for 1 to 2 hours after x radiation exposure of isolated frog eyes. An attempt was made to determine the mechanism of the changes occurring in the retina after exposure to small doses of x radiation. The possibility was considered that the action of x rays on a biological substance gives rise to secondary electrons which, by means of ionization and activation, form active radicals which act upon the visual purple, especially on its protein component which contains a sulfhydryl group. (C.H.)

5241

A γ-RAY SOURCE (GIBE-800) FOR RADIOBIOLOGICAL EXPERIMENTS. A. V. Bibergall', M. M. Korotkov, and O. G. Arakelov (Inst. of Biological Physics, Academy of Sciences of the U.S.S.R., Moscow). Biophysics (USSR) (English Translation) 3, 116-21(1958).

A γ-ray source (GIBE-800) is described, being the first one to allow the dose rate to be altered over a wide range and to permit the irradiation of biological subjects of various dimensions under optimal conditions. Complete safety of the installation is ensured, without the use of scarce materials and complicated, expensive equipment. The irradiation process is automatically controlled by means of a time relay, and the simplicity and reliability of the moving parts means that there is a high degree of reproducibility of experimental conditions. The installation has proved to be quite adequate in work on the experimental irradiation of various biological subjects and can be fully recommended for use in radiobiological research. (auth)

5242

THE ROLE PLAYED BY LOCAL AND DISTANT TOTAL EXPOSURE TO X-RAYS IN OVARY INJURIES IN MICE. O. N. Petrova (Inst. of Genetics, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 123, 1018-21(1958) Dec. 21. (In Russian)

The estral cycle and fertility of female mice were studied in relation to local ovary irradiation and in general irradiation of ovaries and other organs and tissues. Also, separate studies were made of the ovary responses to irradiation of the head only. The tabulated data show that local and general exposure to 100 r produced identical disturbance effects in the estral cycle and fertility of the mice. The estral cycle of mice exposed only to the head irradiation was not disturbed. (R.V.J.)

5243

DISTRIBUTION OF RADIOLUTETIUM (Lu^{177}) IN MOUSE ORGANISMS UNDER VARIOUS INJECTIONS. E. Spode, F. Gensicke, and R. Glaser (Deutschen Akademie der Wissenschaften, Berlin-Buch). Experimentia 14, 456-7(1958). (In German)

The absorption, distribution, and excretion of Lu^{177} in mice after subcutaneous and intraperitoneal injections of 4 μc as the chloride were determined over a period of 30 days after injection. This isotope shows differences in its biological behavior from the lighter rare earths such as lanthanum and cerium. (auth)

5244

THE INTERRELATIONSHIP OF THE SPLEEN AND BONE MARROW IN RADIATION REACTIONS. II. THE EFFECT OF THE SPLEEN ON THE REACTION PICTURE OF THE PERIPHERAL BLOOD AFTER WHOLE-BODY IRRADIATION. R. Bauer and H. Hartweg (Univ. of Tübingen, Ger.). Fortschr. Gebiete Röntgenstrahlen u Nuklearmed. 89, 740-5(1958) Dec. (In German)

Extirpation of the spleen causes a rapid and intense recovery of the blood picture involving both the granulo and lymphopoietic systems following irradiation. The latter does not prevent the leucocytosis following the splenectomy. Irradiated animals with sham operations showed a high mortality, which was not found in those who had undergone splenectomy and irradiation. The red blood count is little affected by radiation, and splenectomy does not exert any reparative influences on this. (auth)

5245

AUTORADIOGRAPHIC AND HISTOPATHOLOGIC STUDIES IN RADIATION CARCINOGENESIS OF THE LUNG. Hermann Lisco (Argonne National Lab., Lemont, Ill.). Lab. Invest. 8, No. 1, 162-70(1959) Jan.-Feb.

Autoradiography has been used in tracing the movement and behavior of plutonium in the lungs of rats who had a single inhalation exposure to a smoke of plutonium oxide. The use of this method has made it possible to correlate the location of the characteristic pathologic changes in the lungs with the sites of deposition of this material. The pathogenesis of the malignant tumors which occurred in many of the animals could be related to the severe focal tissue damage which was produced in the lungs by exposure to plutonium oxide. (auth)

5246

THE EFFECT OF IONIZING RADIATION ON ANTIBODY FORMATION AND DEPENDENCE ON BIOLOGICAL FACTORS. Hans-Stephan Stender (Universität Marburg/Lahn, Ger.). Strahlentherapie 107, 12-41(1958) Sept. (In German)

The effect of radiation on the biological systems which have a share in the formation of the antibodies depends to a high degree on the condition of the cells and on the structure of the lympho-reticular tissue at the time of irradiation. The extent of the primary injury is partly conditioned by the amount of dissolved oxygen contained in the inner cell medium. A preceding activation of the lympho-reticular tissue is apt to increase the resistance of its cells considerably. As the complete development of the injury in the systems tested by the author takes several hours, it is possible to interfere in the injuring chains of reaction stimu-

lated by the radiation, and to accelerate the recovery remarkably. When the injury is fully developed, splenic cell suspensions will have a favorable influence on the restitution. Biological factors play a decisive part in the formation and the extent of the effect of radiation in the lymphoreticular tissue. (auth)

5247

BIOLOGICAL AND BIOCHEMICAL EFFECTS OF IONIZING RADIATION. II. THE REACTION OF THE ORGANISM IN X RADIATION. Hans-Jochim Maurer (Universitäts-Frauenklinik, Erlangen, Ger.). Strahlentherapie 107, 42-77(1958) Sept. (In German)

Therapeutical deep x-ray irradiations effect changes in the organism which, in their kind and their course, conform to the reactions observed after nonspecific irritations. This leads to the conclusion that the effect ionizing radiations on the organism must be considered as a nonspecific stimulus in the way of a stressor, though up to now it has been impossible to clear up the mechanism of the reaction in detail. It may be assumed that, on account of the local radiogenic reactions, the organism forms so-called secondary, or endogenous, stimulants which, in turn, provoke the described reactions. (auth)

5248

INVESTIGATIONS ON A BIOLOGICAL RADIATION PROTECTION. XXIV. EXAMINATION OF THE SPECIFIC RADIATION PROTECTION EFFECT OF THE CYSTEINE-CYSTEAMINE GROUP WITH CONSIDERATION OF A MERCAPTO PYRIDINE DERIVATIVE. Hanns Langendorff, Margarete Langendorff, and Ruprecht Koch (Univ. of Freiburg i. B. and Heilingenberg-Instituts, Heilingenberg/Baden, Ger.). Strahlentherapie 107, 121-6(1958) Sept. (In German)

Some sulfhydryl compounds were examined as to their protective efficiency in mice and rats which had been exposed to total roentgen irradiation. d-Penicillamine and β-d,l-homocystine produce a sensibilizing effect also in rats thus endorsing former results obtained with mice. Thio-malic acid and α-thioglycerin were inefficient. Both findings corroborate our conception that efficient sulfhydril protective bodies are bound to the chemical constitution of the cysteine-cysteamine-group. Against this, however, we find 3-mercaptomethyl-4-oxymethyl-5-oxy-6-methyl-pyridine as a protective body which is outside this group. (auth)

5249

INVESTIGATIONS ON THE THERAPEUTIC POSSIBILITIES IN POISONING WITH RADIOACTIVE FISSION PRODUCTS. III. THE EFFECT ON THE EXCRETION OF RADIOCERIUM OF DELAYED SINGLE INJECTIONS OF DIETHYLENETRIAMINE PENTAACETIC ACID. Alexander Catsch and Du Khuong Lê (Heiligenberg-Instituts, Heiligenberg, Ger.). Strahlentherapie 107, 298-308(1958) Oct. (In German)

The excretion of radiocerium from the organism of the rat can be strongly enhanced by relatively low dosages of diethylenetriamine pentaacetic acid, even if the administration is started 2 weeks after the incorporation. The excretion amounts up to 45% of the body burden; the concentrations in the liver are reduced to about 10%, those in the skeleton to about 60% of the control values. However, therapy must be started within 6 weeks. The administration of parathormone proved to be ineffective. An in vitro test reaction is described which predicts the effectiveness of chelating agents in vivo. (auth)

5250

CHANGES IN THE BLOOD COAGULATION FACTORS PROTHROMBIN, FACTOR V, AND FACTOR VII IN THE RAT AFTER WHOLE-BODY IRRADIATION WITH 1200 r. Paul Gg. Günther, Edith Günther, and Werner Horn (Univ. of Mainz). Strahlentherapie 107, 309-14(1958) Oct. (In German)

In experiments on white rats the influences of a total irradiation with 1200 r on the blood coagulation factors prothrombin, factor V, and factor VII were studied. Whereas in the first two days after the administration of this dose, which caused the death of the control animals after 3 to 3.5 days, the quantities of prothrombin, factor V, and factor VII contained in the blood did not essentially change, the concentration of the coagulation factors began to increase rapidly on the third day. The climax was reached in the terminal stage. The strongest increase was observed in the concentration of prothrombin. (auth)

5251

THE EXTRACELLULAR VOLUME (SULFOCYANIDE SPACE) IN DOGS AFTER WHOLE-BODY X IRRADIATION WITH DOSES OVER LD_{50}. II. Vilmos Varterész, István Fráter, and Béla Wald (Strahlenbiologischen Forschungsinstitut, Budapest and Staatlichen Onkologischen Institut, Budapest). Strahlentherapie 107, 315-20(1958) Oct. (In German)

The reaction of the extra-cellulary volume in dogs at different times after total irradiations with 400 to 600 r was studied. Findings show that the extra-cellulary volume in dogs, when compared to the actual body weight, does not change. If to these findings are added the results of investigations of the plasma and blood volume published in the preceding article, it can be ascertained that while the plasma volume decreases, the fluid extravasating from the vascular system remains in the extracellulary space and consequently does not leave the organism. Owing to the irradiation, the permeability of the capillaries increases, causing a latent edema by the increase of the interstitial fluid quantity proportional to the decrease of the plasma volume. This on the other hand affects the gaseous exchange between blood and tissue and thereby adversely influences the entire metabolism. (auth)

5252

A SMALL CENTER FOR THE CLINICAL APPLICATION OF RADIOISOTOPES. Paul-Otto Buchhorn and Dietrich Frost (Städtische Rudolf Virchow-Krankenhaus, Berlin). Strahlentherapie 107, 321-33(1958) Oct. (In German)

A small center for clinical applications of radioisotopes is described. Only such routine methods as are considered safe are used in it. Based on a given number of patients, the requirements as to building and equipment are explained. Experience over a two-year period is reviewed. (auth)

5253

THE GENETIC DAMAGE OF THE POPULATION BY THE USE OF IONIZING RADIATION IN MEDICINE. III. THE RADIATION DOSE BY X-RAY DIAGNOSIS IN LARGE GENERAL HOSPITALS AND UROLOGICAL CLINICS. Walter Seelentag and Karl Faltenbacher (Univ. of Munich and Städtischen Krankenhauses, Munich). Strahlentherapie 107, 337-53(1958) Nov. (In German)

In this third report of their series the authors present and discuss measurements and results of statistical in-

vestigations made in a big general hospital and in a urological clinic. As in former researches, the x-ray dose per head and generation by x-ray examinations in hospitals on men from 14 to 40 years and on women from 14 to 35 years was found to be less than 200 mr. In x-ray examinations of men and women from 14 to 30 years the dose amounts to less than 100 mr. The authors emphasize the great importance of the examination technique by quoting a number of cases in which poor technique led to an increase of the dose. The results are compared with the figures of the ICRP report of 1957. (auth)

5254

INVESTIGATIONS ON A BIOLOGICAL RADIATION PROTECTION. XXV. THE RELATION OF THIOUREA TO PROTEINS AND TO THE GROUP OF SULFUR-CONTAINING RADIATION PROTECTION DRUGS. Ruprecht Koch (Univ. of Freiburg i. B. and Heiligenberg-Instituts, Heiligenberg/Baden, Ger.). Strahlentherapie 107, 419-25(1958) Nov. (In German)

An investigation was made of the radiation protective action of S-35 thiourea. The investigations show that thiourea is distinctly differentiated from the group of radiation protective substances of the cysteine-cysteamine type. The mode of the protective effect of thiourea and of the cysteine-cysteamine group is discussed. (auth)

5255

INVESTIGATIONS ON A BIOLOGICAL RADIATION PROTECTION. XXVI. EFFECT ON RADIATION PROTECTION SUBSTANCES ON THE METABOLISM CHANGES IN ORGANISMS INHIBITED BY X RADIATION. Ulrich Hagen, Hanna Ernst, and Hanns Langendorff (Univ. of Freiburg i. B. and Heiligenberg-Instituts, Heiligenberg/Baden, Ger.). Strahlentherapie 107, 426-36(1958) Nov. (In German)

In a series of studies concerning the mode of action of organic sulfhydryl compounds for radiation protection, the radiation damage of different organs was studied with and without administration of cysteamine. In the spleen and thymus gland the activation of cathepsin and the decrease of organ weight was recorded 24 and 72 hours after irradiation. By the treatment with cysteamine a dose reduction factor of about 1 results 24 hours after irradiation. After 72 hours the dose reduction factor is about 2 and can therefore be compared with the survival rate after 30 days. If the DNA-synthesis in the spleen is recorded immediately following irradiation no protection can be observed. The radiation damage of the liver, as judged by the inhibition of its DNA-synthesis, shows a marked and immediate onset of protection by cysteamine. In regenerating liver cells with an active DNA-metabolism this protection cannot be observed. It seems possible that a radiation protection by sulfhydryl compounds is only effective if the cells are in the resting stage. (auth)

5256

INVESTIGATION ON THE THERAPEUTIC POSSIBILITIES IN POISONING WITH RADIOACTIVE FISSION PRODUCTS. IV. THE EFFECT OF CHELATES ON THE BIOLOGICAL DISTRIBUTION OF RADIOYTTRIUM. Alexander Catsch and Helga Melchinger (Heiligenberg-Instituts, Heiligenberg, Ger.). Strahlentherapie 107, 437-43(1958) Nov. (In German)

The effect of several chemical compounds on the behavior of carrier-free radioyttrium in the rat was studied following the injection of $Y^{91}Cl_3$. A decreased deposition of yttrium in organs was caused by several polyamino acids and polyphosphate. Most effective for enhancing the excretion was diethylenetriaminepentacetic acid, after both early and late administration. (auth)

5257

GENESIS, PROPHYLAXIS, AND THERAPY OF EARLY RADIATION REACTIONS IN THE BLADDER AND INTESTINES. Karl Arno Hüter and Hans Günther Müller (Städtischen Frauenklinik, Wiesbaden, Ger.). Strahlentherapie 107, 462-7(1958) Nov. (In German)

The authors report on the prophylaxis and therapy of early radiation responses of the bladder and the intestines to treatment with prednisolone-acetate suspension in combination with pantothenic acid, vitamin A, and a sulfonamide. The prophylactic administration led to a significant decrease as regards the number, as well as the gravity, of the reactions whereas the therapeutic application brought about a quick restitution of the normal mucous-membrane conditions. (auth)

5258

INVESTIGATIONS ON THE EFFECT OF X RADIATION ON ERYTHROCYTES AND ITS SIGNIFICANCE FOR THE OCCURRENCE OF ANEMIA AFTER WHOLE-BODY IRRADIATION. Walter Sauerbier (Max-Planck-Institut für Biophysik, Frankfurt am Main). Strahlentherapie 107, 468-77(1958) Nov. (In German)

The author determines the time of survival of autogenous erythrocytes reinjected to the rabbit after x raying in vitro and marking with Cr^{51}. After application of 10 to 230 kr about 20 to nearly 100% of the reinjected cells are eliminated from the blood stream within two days after the reinjection. The preliminary curve of damage is a one-hit curve which allows the conclusion that the death of the cells is caused by enzyme inactivation. (auth)

5259

THE EARLY REACTION OF BLOOD SUGARS DURING X-RADIATION SERIES. Eberhard Schaudig (Chirurgischen Universitätsklinik, Jena, Ger.). Strahlentherapie 107, 485-92(1958) Nov. (In German)

Thirty male patients suffering from bronchial carcinomas were examined after the first and last of a series of roentgen irradiations to determine the changes of the blood-sugar level. At the beginning and at the end of the irradiation series the blood-sugar values increased distinctly. Patients in a bad general condition did not show this reaction. A regular relation between the height of the initial value and the direction or extent of the deflection could not be ascertained. (auth)

5260

THE GENETIC DAMAGE OF THE POPULATION BY THE USE OF IONIZING RADIATION IN MEDICINE. IV. THE RADIATION DOSE BY X-RAY DIAGNOTICS IN CHILDREN'S HOSPITALS. Walter Seelentag, Josef Numberger, et al. (Univ. of Munich). Strahlentherapie 107, 537-55(1958) Dec. (In German)

Statistical investigations and dose measurements on the gonads of 705 children led the authors to the conclusion that the mean quantity of radiation reaching the gonads in x-ray diagnoses in children's hospitals amounts to 77 mr per head/year compared with about 0.1 mr per year/head of the genetically important population. The importance of the technique and of special protective measures is pointed out. (auth)

5261

KINETICS OF THE EARLY CHILDHOOD RADIATION INDUCED ENCEPHALOPATHY. Kurt Kohn and Werner

Schlungbaum (Univ. of Berlin). Strahlentherapie 107, 556-66(1958) Dec. (In German)

A clinical and pathologic-anatomical report is presented of a case of severe radiation-induced encephalopathy in early childhood. A definite conclusion, whether the point of action of the irradiation damage is on the capillaries or on the parenchyma, could not be obtained. The encreased sensibility to irradiation of the juvenile brain requires the radiotherapist to limit the dose and give on optimal distribution of the dose in relation to time and space. (auth)

5262

INVESTIGATIONS ON A BIOLOGICAL RADIATION PROTECTION. XXVII. THE EFFECT OF BONE MARROW TRANSPLANTATION IN VARIOUS MICE STOCKS AFTER X RADIATION. Hanns Langendorff, Margarethe Langendorff, and Ulrich Hagen (Univ. of Freiburg i.B. and Heiligenberg-Instituts, Heiligenberg, Baden, Ger.). Strahlentherapie 107, 567-73(1958) Dec. (In German)

The effect for radiation protection of intravenously administered bone marrow suspension was studied in 2 different mice breeds. In the internationally known mouse breed (LAF_1 animals) a good radiation protection could be observed. This effect could not be observed in mice which were inbred for 21 years. Bone marrow cells of LAF_1 animals were not able to produce a radiation protection in our own animals. An unusual immunological behavior of the animals as cause for the failure may probably be excluded. (auth)

5263

INVESTIGATIONS ON A BIOLOGICAL RADIATION PROTECTION. XXVIII. THE EFFECT OF CYSTEAMINE ON VARIOUS STATES OF THE MITOSIS CYCLE. Hanns Langendorff, Ulrich Hagen, and Hanna Ernst (Univ. of Freiburg i.B. and Heiligenberg-Instituts, Heiligenberg, Baden, Ger.). Strahlentherapie 107, 574-9(1958) Dec. (In German)

The effect of cysteamine on the radiation-induced inhibition of DNA-synthesis was studied in regenerating liver cells of the rat. If the animals were irradiated when the liver cells were at rest, almost no inhibition of the DNA-synthesis was observed, when cysteamine was given. If the irradiation was performed during the DNA-synthesis, cysteamine had no effect for radiation protection. Histochemical experiments show that the DNA-protein at rest is closely connected with other nucleoproteins, but it seems to be free during the DNA-synthesis. Based on these results, a possible protection mechanism was discussed. (auth)

5264

FACTORS INFLUENCING RADIATION INDUCED MUTATIONS IN PLANTS. II. Howard J. Curtis (Brookhaven National Lab., Upton, N. Y.). Trans. Bose Research Inst. Calcutta 22, 17-24(1958).

It is well proven that radiation can be used to produce genetic variants and is thus a tool of potential value in agriculture. With a greater understanding of the process of gene mutation and of the factors involved in the action of radiation on cells, this method may find increasing application. Although the field is still relatively new, the results so far would indicate that the method cannot be expected to revolutionize agriculture. However, when it is used in conjunction with other techniques, it will play a part in the continual struggle to improve crops. The part to be played is probably twofold. First it will be useful in situations in which the existing stocks show very little variability, and more is needed in order to develop desired characteristics. Secondly, it will be used in situations in which crop plants are already about optimal except for some special single characteristic, controlled by a single gene. An example of the latter case would be a crop variety which is satisfactory except for its susceptibility to a particular disease. It is possible by radiation to alter the plant in this one character only, and save many years in producing a satisfactory crop plant which is also resistant to this disease. (auth)

5265

MUTATING EFFECTS OF THE DECAY OF RADIOACTIVE PHOSPHORUS AFTER INCORPORATION IN CELLS OF ESCHERICHIA COLI. F. Kaudewitz, W. Vielmetter, and H. Freidrich-Freska (Max-Planck-Institut für Virusforshcung, Tubingen, Ger.). Z. Naturforsch. 13b, 793-802(1958) Dec. (In German)

Cells of E. coli labeled with P^{32} undergo inactivation during storage in liquid nitrogen (−196°C). Thawing the samples after storage and plating them immediately on complete medium yield colonies of uniform appearance. However, replica plating on minimal medium demonstrates that during P^{32} decay there occurred a significant increase in nutritionally deficient (auxotrophic) mutants. When 10^{-4} is the survival rate, 0.67% of surviving cells give rise to auxotrophic colonies, 40 to 50% of which have prototrophic sectors. During storage the increase of mutants is linear with respect to inactivation of bacteria and to the fraction of P^{32} decayed. The experiments carried out show that inactivation and mutation are due to the decay of P^{32} atoms incorporated in cellular structures and not to effects of freezing, toxicity of contaminants present in the P^{32} solution, or ionization of β electrons. An increase of mutants by positive selection in the course of inactivation was excluded experimentally. (auth)

5266

THE ABSORPTION AND TRANSLOCATION OF P^{32} IN PLANTS OF PHASEOLUS VULGARIS IN THE PRESENCE OF POLYETHYLENE GLYCOL AND INDOLE ACETIC ACID. E. Betto, R. Foa, and A. Volpi (Univ. of Milan). pp. 249-56 in "Atti del Congresso Scientifico. Volume I. Sezione Nucleare, Giugno 1957." (In Italian)

A tracer study was made of the absorption and translocation of P in the presence of polyethylene glycol and indoleacetic acid. The results showed that the presence of glycol causes a better absorption and relative translocation of the phosphorus. The addition of indoleacetic acid causes no further increase in absorption or translocation. Separate studies confirmed that indoleacetic acid does not affect the absorption and translocation of phosphorus. (J.S.R.)

5267

SOME EXPERIMENTS ON NUCLEAR TECHNOLOGY DEVELOPMENT. Joseph Katz (Argonne National Lab., Lemont, Ill.). pp. 289-94 in "Atti del Congresso Scientifico. Volume I. Sezione Nucleare, Giugno 1957."

A brief survey is presented of some recent work with deuterium and tritium in the field of biology. A simple method for the preparation of tritium-labeled compounds with high specific activity is described. The difference in the behavior of hydrogen and deuterium in living systems is described. (J.S.R.)

5268

THE APPLICATIONS OF NUCLEAR ENERGY TO

AGRICULTURE AND BIOLOGY. R. A. Silow (Food and Agriculture Organization of the United Nations, Rome). pp. 401-11 in "Atti del Congresso Scientifico. Volume I. Sezione Nucleare, Giugno 1957."

In agriculture the application of atomic energy can be considered under four main headings: power applications, the use of radiation in food preservation, the use of radiation in plant breeding, and the use of radioisotopes in agricultural research. A discussion is given of these areas. (J.S.R.)

5269

PROTECTION AND RECOVERY FROM RADIATION DAMAGE. Alexander Hollaender (Oak Ridge National Lab., Tenn.). pp. 413-27 in "Atti del Congresso Scientifico. Volume I. Sezione Nucleare, Giugno 1957."

The important developments in radiobiology in the last two years are reviewed. Among the investigations considered are the effects of radiation on the rate of mitosis, radiation effects on chromosome breakage and rejoining, chemical prevention of radiation damage in microörganisms, chemical protection by preirradiation treatment in mammals, recovery from radiation damage, effect of radiation on life span, and protective measures and mutation. 13 references. (J.S.R.)

5270

INDUCTION OF MUTATIONS AND THEIR EXPLOITATION FOR THE IMPROVEMENT OF AGRICULTURAL PLANTS AND DOMESTICATED ANIMALS. Adriano Buzzati-Traverso (Univ. of Pavia, Italy). pp. 429-48 in "Atti del Congresso Scientifico. Volume I. Sezione Nucleare, Giugno 1957." (In Italian)

One of the primary factors in the study of induction of mutations is the possibility for the improvement of plants and domesticated animals. With this objective as a background, a review is presented of investigations on the principal types of mutating agents, the characteristics of the various types of heredity changes arising spontaneously or by induction, and the chief results obtained with respect to selection and genetics. The prospects for this field of study are discussed in general terms with special reference to the needs of Italy. (J.S.R.)

5271

IONIZING RADIATIONS FOR THE CONSERVATION OF FOOD. Duilio Massa. pp. 457-89 in "Atti del Congresso Scientifico. Volume I. Sezione Nucleare, Giugno 1957." (In Italian)

The problem of conservation of foods by ionizing radiations is considered in its general aspects. The various types of radiations are described. The ionizing radiation affects the activity of microörganism in the food, of autolytic enzymes contained in animal or vegetable foods, and the action of parasites in the food materials. Each of these effects are discussed. The side effects produced by irradiation are considered. The possible uses of irradiation for food conservation are briefly reviewed. (J.S.R.)

5272

UTILIZATION OF RADIOACTIVE ISOTOPES IN MEDICINE. Alfred Vannotti (Clinique Medicale Universitarie, Lausanne, Switzerland). pp. 493-501 in "Atti del Congresso Scientifico. Volume I. Sezione Nucleare, Giugno 1957." (In French)

Radioisotopes are used in therapy for whole-body irradiation, local irradiation, and internal treatment after intravenous injection. Local irradiation is briefly discussed, but a more detailed report is presented on the injection of the radioisotopes of phosphorus and iodine. (J.S.R.)

5273

APPLICATION OF RADIOISOTOPES IN CLINICAL DIAGNOSIS. Lorenzo Antognetti (Univ. of Genoa). pp. 503-30 in "Atti del Congresso Scientifico. Volume I. Sezione Nucleare, Giugno 1957." (In Italian)

A survey is presented of the uses of radioisotopes in endocrinological diagnosis, hematological diagnosis, cardiocirculatory diagnosis, studies of the hepatic and kidney functions, and tumor diagnosis. (J.S.R.)

5274

RADIOACTIVITY OF THE HUMAN BODY. Leonida Marinelli (Argonne National Lab., Lemont, Ill). pp. 531-49 in "Atti del Congresso Scientifico. Volume I. Sezione Nucleare, Giugno 1957."

Studies made on the radioactivity of the human body are reported. The special cubicle, positioning of the subject in the cubicle, and the sensitive scintillation spectrometer used for measurement of the radioactivity are described. Some results obtained are presented. The detection of Cs^{137} in the human body is discussed. (J.S.R.)

5275

EXAMINATION OF THE THYROID FUNCTION IN SOME NEPHRITIC DISORDERS. Enrico Fiaschi, Luciano Campanacci, et al. (Univ. of Rome). pp. 551-62 in "Atti del Congresso Scientifico. Volume I. Sezione Nucleare, Giugno 1957." (In Italian)

A tracer study was made of iodine metabolism during nephritic disorders. It was found that in chronic nephrosis the radioactivity of the plasma protein approached the radioactivity of the total plasma. The decrease of the plasma radioactivity is much more rapid in chronic nephrosis than in other nephritic disorders. (J.S.R.)

5276

VALUES AND LIMITS OF THE PLASMA RATIO OF CONVERSION OF I^{131} IN THE DIAGNOSIS OF THYROID DISEASES. Ivo Baschieri and Luciano Campanacci (Univ. of Rome). pp. 563-72 in "Atti del Congresso Scientifico. Volume I. Sezione Nucleare, Giugno 1957." (In Italian)

The ratio of the iodine conversion was studied by tracer techniques to determine its efficiency in the diagnosis of thyroid disorders. (J.S.R.)

CHEMISTRY

General

5277 58USB5931-1(Pt.1)

United States Borax Research Corp., Anaheim, Calif.

RESEARCH ON INORGANIC POLYMER SYSTEMS. Quarterly Report [for] July 1–September 30, 1958. Oct. 15, 1958. 55p. Project No. 8-(8-7340). Contract AF(616)-5931.

Investigations on the chemistry of thermally stable inorganic or semi-inorganic polymer systems showing promise of utility at 1000°F are presented. The bonding systems presently under study are B-B, B-N, and Al–O. The preparation of prototype compounds and initial polymerization studies involving these systems are described. (auth)

5278 CF-59-1-49

Oak Ridge National Lab., Tenn.

THORIUM OXIDE SLURRY FILTRATION: PRELIMI-

NARY TESTS OF A 3-MICRON POROLOY SINTERED FILTER; RUNS 11, 12 AND 13 IN LOOP L-4-24S. D. T. Jones and J. M. Baker. Jan. 9, 1959. 21p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

A Poroloy sintered-metal filter unit which was placed in a bypass arrangement in a 5-gpm loop, L-4-24S, for runs 11 and 12 was used to separate water from a flowing stream of thoria slurry. During runs 11 and 12, the filter unit prevented the accumulation of thoria in the horizontal pressurizer during 490 hr of operation at temperatures up to 250°C and circulating stream concentrations up to 490 g Th/kg H_2O. Run 13 was made with the main stream of the loop flowing through the center of the filter. The flow velocity through the center of the filter was sufficiently high to prevent a filter cake from building up, and consequently, the filter unit was rendered ineffective. Microscopic examination of the filter screen revealed no other reason for the ineffectiveness of the filter in run 13 other than the lack of filter cake. Further testing with and without cake buildup is scheduled for work in the pump test stand and in L-4-24S. (auth)

5279 IDO-14454

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

THE PARTITION OF URANIUM(VI) BETWEEN TRIBUTYL PHOSPHATE AND BASIC ALUMINUM NITRATE SOLUTIONS. James W. Codding, Jr. Dec. 12, 1958. 33p. Contract AT(10-1)-205. $1.00(OTS).

The extraction coefficients (organic/aqueous) for tracer uranyl nitrate between various solutions of basic aluminum nitrate ("DIBAN") and 5 per cent TBP have been investigated, and the data are presented and correlated. A correction to the extraction data for uranyl hydrolysis and nitrate complexing is included. Through the application of activity coefficients a system of correlation is developed which brings the data into line with the generally accepted mass action law for the extraction of the species $UO_2(NO_3)_2 \cdot 2TBP$. The thermodynamic equilibrium constant for this extraction system is evaluated as $K_E = 50.8\ M_{TBP}^{-2}\ m_{NO_3}^{-2}$, with the activity coefficient vs. ionic strength relationship appearing in good agreement with that of similar solvent extraction systems. A method is outlined by which the activity coefficient values can be used to extrapolate uranium distribution data to provide X-Y diagrams for process design in the acid-deficient aluminum nitrate–TBP solvent extraction system. (auth)

5280 ISC-1049

Ames Lab., Ames, Iowa.

SEMI-ANNUAL SUMMARY RESEARCH REPORT IN CHEMISTRY FOR JANUARY–JUNE 1958. Sept. 15, 1958. 80p. Contract W-7405-eng-82. $2.25(OTS).

Physical and Inorganic Chemistry. The order of elution of rare earth and common elements with EDTA, HEDTA, and citric acid was established. Neodymium–praseodymium mixtures have been successfully separated using 0.026 M ammonium nitrilotriacetate at pH's of 6.0 and 9.0, 0.016 M ammonium diaminodiethylethertetraacetate at pH 8.9, and 0.015 M ammonium diaminocyclohexanetetraacetate at pH 8.4, using Cu as a retaining ion. The process for separating Sc from thortveitite ore is presented. The preparation of YF_3 by the reaction of Y_2O_3 and ammonium bifluoride is presented. Heat capacity measurements on praseodymium from room temperature to 1100°C have been completed, and the results are summarized. The heat capacity of thulium in the temperature range 13 to 350°K was measured. A study of the phases of the YF_3–Y_2O_3 system has begun. The study of the phases of the La–Y alloy system is nearly complete. The surface tensions of the binary fused salt systems $AgNO_3$–$NaNO_3$ and $AgNO_3$–KNO_3 have been measured by the maximum bubble pressure method, and results are presented. Pyrometallurgy. Extraction experiments have been run to determine the removal of Pu from U by its extraction in immiscible metals and its distribution coefficients between the metals. Analytical Chemistry. By means of a conductometric method the concentration of HF in the atmosphere in the hydrofluorination rooms was found to be less than one microgram per liter of air. Work continued on a high-temperature fluorination technique for the determination of O_2 in metals and salts. An analytical method was developed for the determination of rare earths in Th provided the wt. ratio of Th to rare earth is not greater than 1000. A method for the titrimetric determination of Sc has been developed. Spectrochemistry. The emission spectrometric technique for the determination of O_2 in metal has been extended to the determination of O_2 in Nb in the concentration range 0.007 to 0.5%. A spectrometric method is presented for the determination of nitrogen in steel. The infrared spectra of mono-, di-, and triaryl substituted silanes were studied over the region from 5000 cm^{-1} to 450 cm^{-1} and the various silicon–hydrogen vibrational bands identified. Radiochemistry. The decay of Sb^{127} is presented. The research program on the recoil chemistry of C in organic compounds is continuing. The reactions of the cobalt cyclopentadiene compounds are being studied. (For preceding period see ISC-976.) (W.L.H.)

5281 KAPL-M-ELS-10

Knolls Atomic Power Lab., Schenectady, N. Y.

PRECISION STUDIES ON THE DETERMINATION OF NITROGEN IN ZIRCONIUM AND ZIRCALOY. E. L. Shirley, J. R. Ciaranello, and G. R. Smith. Dec. 23, 1958. 12p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

The chemical analysis of nitrogen in zirconium and zirconium alloys is routinely performed at various sites. In an attempt to measure and possibly improve the accuracy and precision of this determination, a study was made of ammonia analyses using both micro and macro distillation apparatus. Recovery data are shown for variations in the chemical procedure as they affect the accuracy and precision of the determination. (auth)

5282 KAPL-M-GHB-1

Knolls Atomic Power Lab., Schenectady, N. Y.

RESULTS OF THERMAL CYCLING STRESS CORROSION TESTS OF TYPE-347 STAINLESS STEEL IN 500 F pH 10-11 LITHIUM HYDROXIDE. G. H. Borrmann and G. E. Galonian. Jan. 8, 1959. 18p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

The results of a one-month thermal cycling corrosion test of three stressed T-347 stainless steel bolts exposed to 500°F pH 10 to 11 lithium hydroxide are described. Tests were made to evaluate corrosion of stressed T-347 and T-304 stainless steel under conditions of water leakage to the atmosphere. (W.D.M.)

5283 KAPL-M-SMS-97

Knolls Atomic Power Lab., Schenectady, N. Y.

RADIOCHEMICAL MEASUREMENTS OF IN-PILE LOOP

CORROSION PRODUCT DEPOSITS AND THEIR INTERPRETATION, JULY 17, 1955–APRIL 7, 1958. S. Yerazunis and R. E. Larson. Dec. 31, 1958. 40p. Contract W-31-109-Eng-52. $6.30(ph OTS); $3.00(mf OTS).

Radiochemical measurements on fuel element cruds, out-of-flux deposits, ion exchange accumulations, and particulate corrosion products circulating in the coolant which were obtained from the KAPL-37 and KAPL-30 test facilities were studied. On the basis of these data, it was concluded that no single transport mechanism could account for the observed effects. A simplified mathematical model describing loop activation by the transport of particulate crud and by the diffusion of active nuclides was derived and applied to the KAPL-37 data. Within the limitations imposed by the assumptions required to develop the loop activation equations and the limits of accuracy applied to the experimental data, the activation of the KAPL-37 loop and fuel element deposits could be described on the basis that 81 to 92% of the influx deposits were transient, and therefore erodable, and that up to 24% of the system crud could take part in an exchange process with the coolant. Resuspension of out-of-flux cruds, a mechanism not included in the loop activation equations, was determined to be occurring in the KAPL-30 facility. Circulating coolant activity as derived from hot crud filter and filtrate samples was found to be considerably less satisfactory than estimates obtained from ion exchange accumulations. (auth)

5284 KAPL-M-WSH-4

Knolls Atomic Power Lab., Schenectady, N. Y.

THE DETERMINATION OF MICROGRAM QUANTITIES OF THORIUM IN ZIRCALOY II BY X-RAY FLUORESCENCE SPECTROSCOPY WITH ION EXCHANGE MEMBRANES. W. S. Horton and W. D. Moak. Jan. 12, 1959. 11p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40 (mf OTS).

A method for the determination of microgram quantities of thorium in Zircaloy-2 is described. The sample is dissolved in a mixed acid (HBF_4–H_2SO_4–HCl). An ion exchange membrane, after being stirred in the solution, is placed in the x-ray fluorescent spectrometer, and the main thorium emission line is excited by a primary beam of x rays from a tungsten target tube. (W.D.M.)

5285 LAMS-1841(Del.)

Los Alamos Scientific Lab., N. Mex.

THE REACTION OF URANIUM WITH PURIFIED WATER. S. F. Waber and J. T. Waber. Dec. 1951. Decl. with deletions Dec. 10, 1956. 132p. Contract W-7405-eng-36. $21.30(ph OTS); $6.90(mf OTS).

The reaction of uranium with pure water at 50°C has been followed by measuring hydrogen evolution. Three advantages of this method are: a material balance between reactants and products may be made, the amount of hydrogen evolved can be compared with the amount of uranium consumed, and air and CO_2 can be excluded from the apparatus during a run. A complete description of the apparatus and full discussions of each run are presented. Also, many data concerning earlier uranium corrosion work are reviewed in detail. In general, the corrosion behavior of uranium is that of a zero-order chemical reaction. Thermodynamic considerations show that the formation of UO_2 is the most favorable reaction although there is evidence in the literature and from these experiments that supports the formation of some UH_3. The yield of hydrogen, as a result of the conversion of uranium to UO_2 by the water, is less than should be accounted for from the measured weight loss of the uranium specimens. However, correlation of the test duration with the amount of missing hydrogen, or with the amount of hydrogen present in the corrosion products, is not possible; nor can the discrepancy be accounted for by leaks in the apparatus. Less uranium has been found in the corrosion products than would be expected if the consumed uranium was all converted to UO_2. Better agreement will result if the assumption is made that a 2 to 1 mixture of UO_2 and $UO_2 \cdot 2H_2O$ is formed. Oxygen has been found to exert little direct effect on the corrosion reaction. (auth)

5286 NAA-SR-3090

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

A MECHANISM STUDY OF THE OXIDE-DROSSING OF CERIUM FROM MOLTEN URANIUM WITH URANIUM DIOXIDE. T. Smith. Dec. 15, 1958. 64p. Contract AT-11-1-GEN-8. $1.75(OTS).

The mechanism of the oxide-drossing process for extracting cerium from molten uranium has been investigated; the extraction was studied from the standpoint of reaction kinetics and thermodynamics, by chemical analysis, metallography, and x-ray diffraction techniques. It was concluded from this study that the extraction is controlled by different mechanisms during four consecutive time periods. The extraction is initially controlled by chemical reaction at the uranium–uranium dioxide interface, which is quickly superseded by the slower diffusion of cerium from the bulk uranium to the interface. During these periods a reaction product layer is formed and the reaction becomes controlled by the diffusion of cerium through the film. The reaction finally approaches equilibrium in the fourth time period and the concentration of cerium in the uranium comes to an equilibrium value. The second and third period follows an equation of the form $\log(C_0 - C_1)/(\overline{C}_1 - C_1) = kt + 1$. Equations relating the apparent diffusion coefficients with temperature for the second and third reaction periods are $D_2 = 5.4 \times 10^{-3}\, e^{-12,800/RT}$ and $D_3 = 2.2 \times 10^{-4}\, e^{-26,200/RT}$, respectively. (auth)

5287 NP-7077

Du Pont de Nemours (E. I.) & Co. Eastern Lab., Gibbstown, N. J.

RESEARCH ON SYNTHESIS OF 1000 DEGREES F. STABLE BASE FLUIDS. Progress Report No. 2 [for] September–November 1958. J. A. Perkins. Dec. 15, 1958. 11p. Contract AF33(616)-5843.

A technique for substitution of fluorine for chlorine in liquid phosphorus chloronitride was found. Fragmentary evidence was obtained that antimony chloronitride was prepared in a hot-tube reaction followed by the depolymerization technique employed with phosphorus chloronitride. Preparation of valentinite in larger quantities permitted preparation of what appears to be polymeric methyl stiboxane. Investigation of the zone-melting method of screening for eutectics was started, and conditions favoring melting-point depression for eutectic compositions were formulated. (auth)

5288 NP-7085

Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.

SPEKTROGRAPHISCHE BESTIMMUNG VON VERUNREINIGUNGSSPUREN IN LOSUNGEN AUF METALLELEKTRODEN IN FUNKEN. (Spectrographic Determination of Trace Impurities in Solutions on Metal Electrodes in a Spark.) Report No. 31/VIII. J. Czakow,

T. Steciak, and O. Szczerbinska. June 1958. 12p.

The application of the "copper spark" method to the determination of trace amounts of Al, As, Be, B, Cd, Ca, Ce, Cr, Cu, Fe, La, Pb, Mg, Mn, Ni, P, Si, Ag, Na, Te, and Sn in solutions of isotopes of low radioactivity and containing phosphate, sulfate, and iodide ions is given. The calculated variability coefficient for ΔS solutions with a concentration of 1 μg Ni/ml was ±5% for 95% accuracy. A purification method for the auxiliary electrode and the use of the standard paper density scale for quantitative determinations are given. (tr-auth)

5289 NP-7121

Brussels. Centre d'Étude de l'Énergie Nucléaire.
EXPERIENCE P_5—ANALYSE D'ECHANTILLONS D'AL PAR SPECTROMETRIE GAMMA. (Analysis of Al Samples by Gamma Spectrometry.) Apr. 23, 1958. 5p.

A step-wise procedure for the determination of manganese in aluminum by gamma spectroscopy of the irradiated samples is described. (J.S.R.)

5290 NP-7147

Brussels. Centre d'Étude de l'Énergie Nucléaire.
MESURE DE L'ACTIVITE α ET β TOTALE DES EAUX DE SURFACE. (Measurement of the Total α and β Activity of Surface Waters.) R. Vaninbroukx and E. Van Der Stricht. June 27, 1958. 15p.

The procedures used to determine the total alpha and beta activity of surface waters are given. The calculation of the errors in the radioactivity measurements is discussed, and the minimum concentration for alpha detection is considered. (J.S.R.)

5291 NP-7197

Northwestern Univ., Evanston, Ill.
CHEMISORPTION OF OXYGEN ON NICKEL (thesis). Technical and Summary Report [on] BASIC RESEARCH ON THE MECHANISM OF CHEMISORPTION ON METALS. Robert J. Leak. Nov. 20, 1958. 87p. Contract DA-11-022-ORD-2285.

The chemisorption of oxygen on nickel—silica catalyst systems was investigated by the low-frequency a-c permeameter method and volumetric gas adsorption techniques. The nickel particles were in the superparamagnetic diameter range or slightly larger. A method was developed for distinguishing between true chemisorption of oxygen on nickel as contrasted with surface oxide formation. This method makes use of what appears to be a change of magnetic anisotropy energy in particles of metal in the 100 A diameter range. The so-called "hydride" anomaly in the chemisorption of hydrogen on nickel at low temperatures was resolved. (auth)

5292 NP-7221

Monsanto Chemical Co., Everett, Mass.
RESEARCH ON SYNTHESIS OF 1000°F. STABLE BASE FLUIDS. Quarterly Report No. 3 for September 1, 1958—November 30, 1958. James W. Dale, Iral B. Johns, and Elizabeth A. McElhill. 29p. Contract AF33(616)-5553.

The present investigation involves a fairly basic multipronged approach to the problem of preparing thermally stable fluids liquid at room temperature and usable to 1000°F. In the course of this study the vapor phase thermal stability of a number of resonance stabilized building blocks is being determined. This survey is now complete, and the new results are given in this report. The influence of pressure on the thermal stability of a number of bi or poly ring systems has been determined. In addition, the thermal stability of a number of compounds containing C-N, C-P, P-S, and C-F bonds has been determined. Hexafluorobenzene is the most stable compound evaluated to date in the vapor phase recycle thermal stability apparatus. This compound did not decompose at ~1230°F, the temperature limit of the equipment. It was previously reported that hexafluorobenzene decomposed at about 1000°F in the recycle apparatus using a Vycor reactor. As suggested this temperature was the temperature at which Vycor reacted with hexafluorobenzene. The new higher value for the stability of hexafluorobenzene has been obtained in a recycle apparatus with a monel metal reactor. With the exception of diphenyl, all compounds so far tested are less stable in the condensed or critical region than in the gas phase at atmospheric pressure. (auth)

5293 NP-7238

Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.
EFFECTS OF CHLORIDES AND SULPHATES ON EXTRACTION OF URANIUM AND IRON BY TRI-N-BUTYL PHOSPHATE. Report No. 53/IV. W. Korpak and C. Deptuka. Dec. 1958. 17p.

Experiments were performed to determine the effects of chlorides and sulfates on the extraction of $UO_2(NO_3)_2$. The effects of chlorides on the extraction of Fe^{3+} in the presence of $UO_2(NO_3)_2$ were investigated. Sulfates were found to reduce the yield of U from nitrate leaching solutions. No perceptible effects of chlorides on U extraction were revealed, but they increased the content of Fe in the organic phase. (W.L.H.)

5294 NYO-6370

Princeton Univ., N. Y. Project Matterhorn.
RECOVERY OF TRITIUM FROM DILUTE SOLUTIONS OF LITHIUM TRITIDE IN LITHIUM. Technical Memorandum No. 25. Ernest F. Johnson. [1955]. Decl. Sept. 22, 1958. 6p. $1.80(ph OTS); $1.80(mf OTS).

Two methods, one based on crystallization and the other on distillation, are briefly described. (L.M.T.)

5295 NYO-6678

Pennsylvania State Univ., University Park. Coll. of Mineral Industries.
AN INVESTIGATION OF THE CHEMICAL NATURE OF THE ORGANIC MATTER OF URANIFEROUS SHALES. Semiannual Report Covering the Period October 1, 1957 to March 31, 1958. C. R. Kinney, J. T. Leonard, J. P. Chen, and A. Weinstein. Apr. 30, 1958. 28p. Contract AT(30-1)-1442. $4.80(ph OTS); $2.70(mf OTS).

Studies on ozonization, solvent extraction, and chemical properties have been actively underway, and the results accomplished are given. Of particular interest is the extraction of silica and alumina by hydrochloric acid followed by the solution of over 35% of the whole shale in hot dilute sodium hydroxide mainly as silica. Other mineral studies include the action of ozone on pyrite which produces mainly ferrous sulfate and sulfur trioxide, but also a small amount of elemental sulfur, which possibly may be present in the pyrite in this form. Attempts to separate the kerogen of the shale and the mineral components have not been entirely successful. (For preceding period see NYO-6677.) (auth)

5296 NYO-7717

Pennsylvania State Univ., University Park. Coll. of Chemistry and Physics.
RACEMIZATION OF OPTICALLY ACTIVE COM-

PLEXES. I. CATALYTIC RACEMIZATION OF TRIS(ETHYLENEDIAMINE)COBALT(III) IODINE. II. CATALYTIC RACEMIZATION OF TRIS(ETHYLENEDIAMINE)PLATINUM(IV) CHLORIDE AND TRIS(ETHYLENEDIAMINE)RHODIUM(III) CHLORIDE. Debabrata Sen and W. Conard Fernelius. Dec. 1956. 12p. Contract AT-30-1-907. $3.30(ph OTS); $2.40(mf OTS).

Catalytic racemization of the tris(ethylenediamine) cobalt(III) iodide has been studied in the presence of active carbon, platinum black, and silica gel. Exchange studies of the cobalt complex with the C^{14}-labeled ethylenediamine were also made in order to find some clue to the mechanism of the racemization process. It was concluded that the complex first is activated and then racemizes. This process is accompanied by partial decomposition of the complex. (auth)

5297 UCRL-8455

California. Univ., Berkeley. Radiation Lab.
THERMAL IONIZATION AT HOT METAL SURFACES (thesis). Joseph R. Werning. Sept. 1958. 63p. Contract W-7405-eng-48. $1.75(OTS).

Ionization on hot tungsten, tantalum, and rhenium surfaces was studied. An atomic beam of neutral atoms effused from a Knudsen-type effusion vessel and struck a hot filament of the metal being studied. A temperature-dependent fraction of these atoms was ionized. This filament served as the ion source of a 60-degree-sector single-directional focusing mass spectrometer. According to the Saha-Langmuir theory of surface ionization the temperature dependence of ionization is related to the difference between the ionization potential of the impinging atom and the work function of the surface under consideration. The temperature dependence of the positive ion current produced by barium atoms impinging onto tungsten, tantalum, and rhenium filaments was measured over a wide range of filament temperatures. At temperatures higher than 2500°K excellent agreement with the Saha-Langmuir theory was obtained. Using the value of 5.21 electron volts for the ionization potential of barium, 4.58 ± 0.01 ev for the work function of tungsten and 4.23 ± 0.03 ev for the work function of tantalum were obtained. Both values are in excellent agreement with generally accepted values determined by independent means. On rhenium the Ba^+ ion current was found to be essentially independent of temperature, indicating a work function equal to or appreciably higher than the 5.21 ev ionization potential of barium. Using the strontium ionization potential of 5.69 ev, a tantalum work function of 4.17 ev was obtained, a value in reasonable agreement with that above. The strontium study yields a value of 5.17 ± 0.02 ev for the work function of rhenium, a value consistent with the study noted above. The positive ion current produced by uranium atoms impinging onto a tungsten filament indicates an ionization potential of 6.25 ± 0.02 ev for the uranium atom. This value is based on the 4.58 ev work-function value for tungsten. The neodymium ion current produced on a tungsten surface indicates an ionization potential of 5.10 ± 0.04 ev for neodymium. This is based on the 4.58 ev tungsten work function. At temperatures below 2000°K order-of-magnitude deviations from the extrapolated Saha-Langmuir theory were found. For barium and strontium the positive ion current was in excess of the value predicted by extrapolation of the high-temperature straight line. For uranium and neodymium the low-temperature currents were generally less than the extrapolated values. It was found that positive ions are produced in chemical reactions taking place on the surface of the metal. Barium reacts readily with oxygen from the gas phase and with oxygen and fluorine diffusing from the interior of the metal. The products of these reactions decompose, yielding barium ions in high efficiency. BaF^+ ions are also observed. The behavior of strontium is similar to the behavior of barium. Uranium atoms react with oxygen on the surface, producing UO^+ and UO_2^+ ions, the uranium ion current being decreased by the presence of oxygen. The behavior of neodymium is similar to the behavior of uranium, with the exception that no NdO_2^+ ions are observed. At temperatures below 2000°K each system was found to have its own chemical properties and these must be resolved on an individual basis rather than by recourse to general surface properties such as bulk work functions, surface inhomogeneties, or reflection coefficients. (auth)

5298 UCRL-8457

California. Univ., Berkeley. Radiation Lab.
BIO-ORGANIC CHEMISTRY QUARTERLY REPORT [FOR] JUNE, JULY, AUGUST 1958. James A. Bassham, ed. Sept. 18, 1958. 54p. Contract W-7405-eng-48. $1.50(OTS).

An ionization chamber in combination with a vibrating-reed electrometer and a recorder provides precise and sensitive measurements of radioactivity. In order to realize further the possibilities of this method, four special-purpose ionization chambers were designed, built, and partially tested. Experiments were performed to determine whether paramagnetism in charge-transfer complexes depends on the donor, acceptor, or both. The proton-resonance spectra of cyclopentadiene, methylcyclopententadiene, cycloheptatriene, and trimethylsilicon chloride were undertaken to determine the spectra occasioned by hydrogen atoms in different molecular environments. The difference between the NMR spectra of cyclopentadienyl compounds with a "sandwich" structure and those with localized metal-carbon bonds is discussed. The photovoltaic effect and photoconductivity were studied in laminated organic systems. The electrical properties of pure and "doped" organic semiconductors were studied. The light-dark effect in Chlorella and Scenedesmus was studied in the presence of $C^{14}O_2$. Attempts to prepare active carbon dioxide compounds are reported. The toxicity of D_2O for Drosophila melanogaster is discussed. (For preceding period see UCRL-8421.) (W.L.H.)

5299 WADC-TR-58-349

Baylor Univ., Waco, Tex.
THE CHEMISTRY OF THE LOWER VALENCES OF TITANIUM. Thomas C. Franklin and Haig Verne Seklemian. Aug. 1958. 63p. Contract AF33(616)-3331. (AD-155694).

A study was conducted to identify and characterize the lower valence states of titanium (normally tetravalent), with a particular view to establishing whether divalent compounds do in fact have stable existence. Several methods for the preparation of divalent titanium were investigated: disproportionation of titanium tetrabromide, reduction of titanium tetrachloride, dissolution of the metal in aqueous and anhydrous acids, and the anodic dissolution of the acid in various nonaqueous solvents. These techniques failed to produce identifiable quantities of divalent compounds. Solubility and reaction studies were made by extracting commercial "titanium dichloride" with a number of typical solvents. This

substance is insoluble in nonpolar liquids; in polar solvents, or those containing labile hydrogen atoms, slow reactions appear to accompany dissolution. With water, reaction is immediate and hydrogen is evolved. Absorption spectra of these solutions give peaks characteristic of tri- and tetravalent titanium. No other peaks are observed. It is concluded that divalent titanium does not exist to any appreciable extent in solution, and that much of the literature on alleged divalent compounds is probably describing a corresponding trivalent substance. Electrochemical experiments, using both dissolution and deposition techniques, confirm the observation that the lowest stable valence of titanium in solution is three. Divalent titanium appears to be so powerful a reducing agent that oxidation by ordinary solvents proceeds preferentially to any further electrochemical reduction, defeating attempts to plate the metal from media other than fused salts. The thin black deposits obtained in electroplating experiments from a variety of solvents (presumed to be titanium metal by some previous workers) are not elemental titanium, as established by x-ray diffraction and by chemical tests; the exact composition is undetermined and is probably variable. (auth)

5300 WAPD-CTA-GLA-146(Rev.)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
THE DETERMINATION OF NIOBIUM IN URANIUM–NIOBIUM ALLOYS. T. C. Bryson, G. W. Goward, and M. D. Hartmann. Apr. 24, 1956. Decl. Jan. 23, 1959. 4p. $1.80(ph OTS); $1.80(mf OTS).

Niobium is determined as the peroxy complex in concentrated sulfuric acid by photometric measurement at 360 mμ. Uranium interference is cancelled by using a solution of the sample for reference in the photometric measurement. The method covers the determination of niobium in uranium–niobium alloys made from pure melting stock. Molybdenum interferes and must be removed if present. Zirconium does not interfere. The calibration curve covers a concentration range from 0.2 to 5.0 mg. (auth)

5301 WCAP-917
Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.
SPECTROPHOTOMETRIC DETERMINATION OF DISSOLVED OXYGEN IN WATER. B. D. La Mont and N. E. Gordon, Jr. May 15, 1958. 13p. $3.30(ph OTS); $2.40 (mf OTS).

High-pressure boilers or nuclear power plants require an accurate determination of dissolved oxygen in feed and process water to minimize corrosion. Improved sampling and analytical techniques for the Winkler method are proposed. Hypodermic syringes are used to add the reagents to the sampling vessel to prevent atmospheric contamination. The liberated iodine is extracted with chloroform, and the absorbance of the solution is measured to determine the dissolved oxygen content of the water. A known amount of iodine is dissolved in chloroform to prepare a standard curve. Dissolved oxygen in water can be determined in the concentration range of parts per million or parts per billion. (auth)

5302 AEC-tr-3533
ON SOME CHEMICAL PROPERTIES OF THORIUM AND URANIUM. (O Nekotorykh Khimicheskikh Svoistvakh Toriya i Urana.) A. G. Karabash. Translated by Lydia Venters (Argonne National Lab.) from Zhur. Neorg. Khim. 3, 986-95(1958). 13p. $3.30(ph); $2.40(mf) JCL or LC.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 15343.

5303 AEC-tr-3548
THEORETICAL TREATMENT OF THE VAPORIZATION PROCESS. Wilhelm Prüger. Translated by Lydia Venters (Argonne National Lab.) from Sitz. Akad. Wiss. Wien, Math. naturw. Kl. Abt. 11a 149, 31-58(1940). 40p. $7.80(ph); $3.30(mf) JCL or LC.

Problems concerning the determination of vaporization coefficients of solids and liquids are treated by considerations of the molecular energy and exchange of material at the interface between the vaporizing substance and its vapor and by different emission equations, which are obtained by kinetic considerations of the vaporizing materials. Only equations which contain assumptions concerning the force fields between the surface and vapor molecules appear satisfactory. The prospects of a wave-mechanical treatment are emphasized. Qualitative considerations show that the $K_+ - K_-$ of both solids, and liquids, even on the purest vaporizing surfaces, can adopt values smaller than 1. It is shown that the question, whether a superheated vapor at the boiling point also equally superheats the surface of the liquid or whether it leaves the surface at the boiling temperature, cannot be answered by means of special hypothetical assumptions concerning the structure of the liquid. If it is assumed that the potential of the cohesion forces in the liquid a pure position function and independent of the velocity of the molecules, it is evident that the vapor essentially has to show the temperature of the surface. A completely general consideration shows that the average temperature of the vapor, which sets in at a stationary state of the "evaporation" over a superheated liquid, generally depends on the nature of the liquid and can adopt any value lying between the surface and boiling temperatures. (auth)

5304
SENSITIVE MEASURING METHODS FOR RADIO CARBON. G. Krakau and H. Schneider (Univ. of Giessen, Ger.). Atomkernenergie 3, 515-22(1958) Dec. (In German)

Application of radiocarbon (C^{14}) for dating or tracer investigations requires sensitive detection methods. G-M counters, proportional counters, scintillation counters with liquid or solid phosphors, and photographic emulsions find application. The different methods are discussed and compared. A new method using a caved plastic phosphor for sensitive measuring gaseous $C^{14}O_2$, useful for tracer investigations, is described. Finally, the different data of the most important methods are compared. (auth)

5305
SYSTEMATIC ANALYSIS OF THE IMPURITIES OF ZONE-MELTED ALUMINUM AND IRON BY IRRADIATION IN A REACTOR. Jean Gaittet and Philippe Albert. Compt. rend. 247, 1861-3(1958) Nov. 24. (In French)

In studying the possibility of obtaining a very extended separation of numerous radioisotopes produced by the neutron irradiation of zone-melted aluminum and iron, a procedure was perfected for the chemical separation which permits the determination of about thirty elements with a sensitivity higher than or equal to 0.1×10^{-6} on a 1 g sample. (tr-auth)

5306
STUDY OF THE COMBINATIONS OF THE SULFIDES OF THE RARE EARTHS AND OF ALUMINUM. Jean Flahaut, Madeleine Patrie, and Louis Domange. Compt. rend. 247, 1866-9(1958) Nov. 24. (In French)

Aluminum sulfide, as well as gallium sulfide, gives with the rare earth sulfides some well crystallized equimolecular combinations, whose crystallographic properties are described. In the case of lanthanum sulfide, the addition of aluminum sulfide with the ratio Al/Al + La approximately 0.69 leads to the formation of a glass amorphous to x rays and with a low fusion point. (tr-auth)

5307
PHASE BEHAVIOR OF THE SYSTEM $UO_2SO_4-CuSO_4-H_2SO_4-H_2O$ AT ELEVATED TEMPERATURES. F. E. Clark, J. S. Gill, et al. (Oak Ridge National Lab., Tenn.). J. Chem. & Eng. Data 4, No. 1, 12-15(1959) Jan.

The phase behavior of the proposed homogeneous reactor fuel solution $UO_2SO_4-CuSO_4-H_2SO_4-H_2O$ is reported for temperatures up to 355°C. (W.L.H.)

5308
THE UTILIZATION OF A COLD TRAP TO STABILIZE SUSPENSIONS OF UO_2 IN NaK. P. R. Huebotter and W. R. Seitz (General Motors Research Staff, Detroit). Nuclear Sci. and Eng. 5, 11-14(1959) Jan.

Loop studies were made on UO_2–NaK slurries at temperatures up to 1050°F. The maximum UO_2 concentration was 4.15 volume per cent or 35 weight per cent at room temperature. A flow rate of 5.4 ft/sec was required to suspend all of the UO_2 in this slurry at 1050°F. Lesser flow rates were required at lower temperatures. It was discovered that by installing a static cold trap, which was joined vertically upward from the lower horizontal leg of the loop, the slurry became more stable at the higher temperatures. The function of the cold trap is thought to be that of removing, from the circulating slurry, oxygen contamination which may have rendered previous attempts to maintain a stable suspension above 932°F unsuccessful. In the present study, the UO_2 could be easily resuspended after prolonged settling. (auth)

5309
EFFECT OF RADIATION ON CORROSION OF STRUCTURAL MATERIALS BY MOLTEN FLUORIDES. G. W. Keilholtz, J. G. Morgan, and W. E. Browning (Oak Ridge National Lab., Tenn.). Nuclear Sci. and Eng. 5, 15-20(1959) Jan.

A survey of the experimental methods used in testing the radiation stability of molten salts and their corrosion properties is presented. The effects of irradiation on the corrosion of Inconel exposed to fluoride fuel mixtures and on the physical and chemical stability of the fuel mixtures were investigated by irradiating in the MTR capsules filled with static fuel and by operating in-pile forced-circulation loops in the LITR and in the MTR. In the many capsule tests and in the three in-pile loop tests made to date, no major changes have occurred in the fuel mixtures that can be attributed to irradiation, other than normal burn-up of uranium. Metallurgical examinations of the Inconel capsules and tubing have likewise shown no changes in corrosion that can be the result of radiation damage. The low corrosion results obtained for the in-pile loops have been confirmed by chemical analyses for corrosion products in the fuel mixtures. (auth)

5310
THE KINETIC ISOTOPE EFFECT IN THE DECARBOXYLATION OF 2,4-DIHYDROXYBENZOIC ACID IN D_2O SOLUTIONS. A. V. Willi. Z. Naturforsch. 13a, 997-8(1958) Nov. (In German)

The decarboxylation velocity of 2,4-dihydrobenzoic acid was measured in light and heavy water. It follows the equation $v = k_{HA}(A^-) \times (H^+)$ or $k_{DA}(A^-) \times (D^+)$. For the ratio of the constants of the acid catalysis in H_2O and D_2O, $k_{HA}/k_{DA} = 1.7$ was obtained. The conclusion was made that the hydrogen ion transfer to the salicylate ion was the slow and velocity determining step of the reaction. For this mechanism an experimental confirmation obtained by another method is shown. Four examples for $k_H/k_D > 1$ in the velocity determining H^+ transfer are already known. (tr-auth)

5311
THE ISOTOPIC EFFECT IN THE ELECTROLYTIC MIGRATION OF LITHIUM IONS IN MOLTEN LITHIUM BROMIDE AND IODIDE. Arnold Lundén, Stina Christofferson, and Alex Lodding (Chalmers Technischen Hochschule, Goteborg, Ger.). Z. Naturforsch. 13a, 1034-8(1958) Dec. (In German)

By electrolytic migration, Li^7 was enriched in comparison with Li^6 at the boundary between molten LiBr and $PbBr_2$ or LiI and PbI_2. The mass effect was -0.148 ± 0.014 for LiBr and 0.15 ± 0.02 for LiI. An earlier published value for the mass effect in LiBr was therefore corrected. (tr-auth)

5312
ELECTROKINETICS OF LIQUID METALS. A. Klemm (Max-Planck-Institut für Chemie. Mainz). Z. Naturforsch. 13a, 1039-43(1958) Dec. (In German)

Liquid mercury was transported in electroendosmosis investigation in glass apparatus to the cathode. An analysis of the reaction shows that the effect depends, essentially, on the conduction electron losing its drift velocity in the scattered reflection at the wall and on the field strength affecting the ions at the walls outweighing the electron frictional force. (tr-auth)

5313
COMPARISON OF DEUTERO EXCHANGE AND METALLATION OF ALKYLBENZENES. A. I. Shatenshtein and E. A. Izrailevich (Karpov Inst. of Physics and Chemistry, Moscow). Zhur. Fiz. Khim. 32, 2711-16(1958) Dec. (In Russian)

The rate of deutero exchange between a solution of potassium amide (0.02N) in liquid deuteroammonia and the aromatic rings and alkyl groups of the alkylbenzenes, $C_6H_5CH_3$, $C_6H_5C_2H_5$, iso-$C_6H_5C_3H_7$, tert-$C_6H_5C_4H_9$, and n-$C_6H_5C_4H_9$ was measured at 25, 10, and 0°C. It was found that deutero exchange and the metallation of alkylbenzenes by organometallic compounds (Shorygin reaction) obey common laws, explained by the fact that in both cases the strong base protonizes the hydrogen of the CH bond of the hydrocarbon playing the part of a weak acid. (tr-auth)

5314
THE DISSOCIATION OF DEUTEROOCTANE BY ELECTRON IMPACT. M. V. Gur'ev and M. V. Tikhomirov (Karpov Inst. of Physics and Chemistry, Moscow). Zhur. Fiz. Khim. 32, 2731-8(1958) Dec. (In Russian)

The mass spectra of n-octane and n-octane-$2D_1$ were studied at electronic energies of 70 ev. It was shown that during dissociation of the excited molecular ion of n-octane considerable mobility of the hydrogen atoms

may be observed. A number of mechanisms for the dissociation were considered, explaining the mass spectrum of n-octane-$2D_1$. It was suggested that the ion fragments of n-octane $C_nH^+_{2n}$, $C_nH^+_{2n-1}$ .... C^+_n are formed from the $C_nH^+_{2n+1}$ ions by removal of hydrogen atoms. On this basis the mass spectrum of n-octane-$2D_1$ was calculated with satisfactory accuracy from the mass spectrum of n-octane using the ordinary method for calculating the mass spectra of the simple deuterohydrocarbons. (tr-auth)

5315

THE THERMOCHEMISTRY OF ISOTOPES. I. A CALORIMETRIC STUDY OF THE HEATS OF FORMATION OF HYDROGEN SULPHIDE AND DEUTERIUM SULPHIDE. A. F. Kapustinskiĭ and R. T. Kankovskiĭ (Mendeleev Inst. of Chemistry and Tech., Moscow). Zhur. Fiz. Khim. 32, 2810-16(1958) Dec. (In Russian)

A calorimeter was described allowing measurements to be made of the heats of combustion of gaseous hydrogen compounds at constant atmospheric pressure. With the aid of this calorimeter the heats of combustion were measured of hydrogen and deuterium sulfides, and with their aid the heats of formation under standard conditions were calculated; that for the first compound was found to be 4.94 kg cal/mole and for the second, 5.71 kg cal/mole with an accuracy of 1.1 to 1.6%. The corresponding free energy values are 8.02 and 8.48. All this enabled one to establish the isotopic effect on the strength of chemical bonds. The energy of the chemical bond between hydrogen atoms and sulfur equals 81.2 kg cal, whereas between deuterium and sulfur it is 81.5 kg cal. (auth)

5316

SOME PROBLEMS IN CHEMICAL KINETICS AND REACTIVITY. Volume 1. N. N. Semenov. Princeton, N. J., Princeton University Press, 1958. 249p.

The first three sections discuss the reactivity of monoradicals, competition between monoradical reactions, and reactions of diradicals. The last three sections describe the dissociation of molecules and recombination of radicals, initiation of chain reactions by ions of variable valence, and wall initiation and termination of chain reactions. (W.L.H.)

Radiation and Radiochemistry

5317 AERE-I/R-2746

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

GAMMA-RADIATION AND CATALYSIS. THE METHANOL SYNTHESIS OVER ZINC OXIDE. T. I. Barry and R. Roberts. Nov. 1958. 14p.

Possible mechanisms are discussed whereby γ-radiation may affect the catalytic activity of ionic and covalent solids. The influence of γ-rays on zinc oxide, used as a catalyst for the synthesis of methanol, was investigated and a small radiation effect observed. The synthesis, and the influence of radiation, are discussed together with other reported results on γ-irradiation of catalysts. (auth)

5318 COO-213

Chicago Operations Office. Health and Safety Div., AEC.

A REPORT OF BIOASSAY PROCEDURES. A Summary and Bibliography. William A. Brobst. Jan. 21, 1957. 9p. $1.80(ph OTS); $1.80(mf OTS).

Various procedures for the analysis of urine for radioactivity are presented. Details are included for plutonium, thorium, and uranium. A list is included of equipment, with the approximate cost. 16 references. (C.H.)

5319 LA-2245

Los Alamos Scientific Lab., N. Mex.

U^{233} PURIFICATION AND METAL PRODUCTION. J. P. Bertino and J. A. Kircher. Aug. 1958. 46p. Contract W-7405-eng-36. $1.25(OTS).

Two problems are encountered in U^{233} purification and metal production. One is high alpha activity, which requires that all operations be enclosed. The other is beta-gamma activity originating from U^{232} present in U^{233} as a contaminant. Th^{228}, the immediate daughter of U^{232}, produces a chain of strong beta-gamma emitters, which make shielding and thorium separation procedures necessary. Chemically impure solutions of $U^{233}O_2(NO_3)_2$ from Oak Ridge Thorex product or from metal fabrication residues are separated from trace amounts of thorium isotopes by cation resin exchange in shielded equipment. The short-lived thorium daughters are allowed to decay, after which beta-gamma activity is low enough to permit chemical purification in unshielded equipment. The U^{233} is chemically separated from nonradioactive contaminants by precipitation as $UO_4 \cdot xH_2O$, which is calcined to U_3O_8. The U_3O_8 is reduced to UO_2 and converted to UF_4. Pure metal is prepared by bomb reduction of the UF_4 with calcium as the reducing agent. Residues from the chemical purification steps, reduction, metal fabrication, and general cleanup are processed into nitrate solutions, solvent extracted, and concentrated for recycle. Ion exchange, precipitation, reduction to metal, and casting all have effect upon the thorium isotopes and their daughters, resulting in changes in the levels and growth rates of beta-gamma activity. (auth)

5320 LAMS-2236

Los Alamos Scientific Lab., N. Mex.

ALPHA-PARTICLE OXIDATION AND REDUCTION IN AQUEOUS PLUTONIUM SOLUTIONS. Sherman W. Rabideau, Mildred J. Bradley, and Helen D. Cowan. June 1958. 28p. Contract W-7405-eng-36. $1.00 (OTS).

Studies were made of the rate of change of the mean oxidation number of plutonium solutions in perchloric, hydrochloric, and in mixed perchloric-hydrochloric acid solvents. Hydrogen peroxide concentrations were determined in the plutonium solutions. The hydrogen peroxide concentrations in perchloric acid solutions of plutonium are markedly dependent upon the temperature. The higher hydrogen peroxide concentrations are found at the lower temperatures. The rate of alpha particle reduction of plutonium solutions in molar perchloric acid was found to be only slightly influenced by temperature changes. From chemical analyses and gas analyses it was concluded that the perchlorate ion is reduced to the chloride ion by the alpha particle radiation. In hydrochloric acid solutions, the hydrogen peroxide concentrations and the rates of decrease of the mean oxidation number are much lower than in perchloric acid solutions of similar concentration. This inhibition of the reduction process presumably occurs through lowered yields of hydroxyl radicals and the interaction of chlorine and hypochlorous ion with hydrogen peroxide. In perchloric acid solutions of plutonium containing bromide ion, an increase in the mean oxidation number, an alpha particle oxidation process, is found. (auth)

5321 AEC-tr-3534

ON THE REDUCTION OF PLUTONYL SULFATE BY γ RADIATION. M. Pages, C. Ferradini, and M. Haissinskii (Haissinsky). Translated by R. E. Biggers (Oak Ridge National Lab.) from Compt. rend. 245, 1128-9(1957). 3p. $1.80(ph); $1.80(mf) JCL or LC.

The behavior of plutonyl salts in exposure to gamma radiation was examined. Plutonyl sulfate free from Pu(IV) was prepared in sulfuric acid solution and irradiated with radioactive cobalt. The reduction by gamma radiation in aerated sulfuric acid stops at the IV valence state and varies linearly with the absorbed energy. The yield diminishes with the increase of sulfuric acid concentration. (J.R.D.)

5322 AERE-Lib/Trans-800

THE MECHANISM OF SOME SIMPLE CHEMICAL REACTIONS TAKING PLACE UNDER THE ACTION OF IONIZING RADIATIONS. S. Ya. Pshezhetskii and M. T. Dmitriev. Translated by V. Beak (U.K.A.E.A., Atomic Energy Research Establishment) from Uspekhi Khim. 26, 725-67(1957). 72p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 11953.

5323

INVESTIGATION OF FREE RADICALS FORMED IN SOLIDS SUBJECTED TO BOMBARDMENT BY FAST ELECTRONS. Yu. N. Molin, A. T. Koritskii, N. Ya. Buben, and V. V. Voevodskii (Inst. of Chemical Physics, Academy of Sciences USSR). Doklady Akad Nauk S.S.S.R. 123, 882-3(1958) Dec. 11. (In Russian)

An attempt was made to find the short-life-time radicals in solid materials bombarded by fast electrons. Radicals with life-time period of a few minutes were determined by the electron paramagnetic resonance method. (R.V.J.)

5324

EFFECT OF UV AND GAMMA RADIATION ON ACRIDINE SOLUTIONS. III. QUANTUM YIELD OF THE REACTION OF ACRIDINE AND METHYL-9-ACRIDINE WITH CARBON TETRACHLORIDE (λ~3600 A). Nina Ivanoff. J. chim. phys. 55, 768-71(1958) Oct. (In French)

Measurements of the speed of the reaction of acridine and methyl-9-acridine during the irradiation of the solutions with ultraviolet rays of 3600 A and the determination of the quantities of the corresponding acridine salts formed have shown that the quantum yield Q of the acridine reaction is $Q_{acridine} \sim 4.5$ to 5×10^{-3} at 30°C. The quantum yield of methyl-9-acridine is $Q_{m\text{-}acridine} \sim 3.16 \times 10^{-3}$, and the yield of salt formed is $Q_{salt} \sim 2.35 \times 10^{-3}$ at 31°C. $Q_{m\text{-}acridine}$ and Q_{salt} are independent of the intensity and the initial concentration of methyl-9-acridine and are dependent on the temperature. The ratio $Q_{anthracene}/Q_{acridine} \sim 100$. The reactivity of acridine and anthracene toward carbon tetrachloride exposed to γ radiation are of the same order of magnitude. (tr-auth)

5325

CHEMICAL EFFECTS OF IONIZING RADIATIONS ON AQUEOUS SOLUTIONS OF VANADIUM. II. REDUCTION BY γ RAYS OF THE PEROXYVANADIC ION IN ACID MEDIA. Christiane Ferradini and Jacques Pucheault (Inst. of Radium, Paris). J. chim. phys. 55, 772-81(1958) Oct. (In French)

Sulfuric and aerated solutions of peroxyvanadic ions containing nonperoxided pentavalent vanadium were irradiated by Co^{60} gamma rays. The reduction yields of either ionic species was dependent on their relative concentrations, while the total reduction yield of tetravalent vanadium is independent of it ($G_{VO^{2+}} = 6.5$). The quantitative interpretation of the results was made by adopting the same hypothesis which was necessary to explain the reduction of nonperoxided V^{5+} ions alone (J. chim. phys. 54, 659(1957)). Moreover, two chemical reactions should be considered in the chemical calculations: the catalytic decomposition of peroxyvanadic ions in the presence of tetravalent vanadium and the oxidation of the tetravalent ions by oxygenated water. (tr-auth)

5326

PRELIMINARY INVESTIGATIONS ON THE PREPARATION OF TRANSPARENT GELS OF THORIUM SUCCINATE. Y. D. Upadhaya and S. P. Mushran (Univ. of Allahabad, India). Naturwissenschaften 45, 514(1958). (In German)

The gels are prepared by the metathesis of sodium succinate and thorium chloride solutions of suitable concentrations in the presence of glucose solutions. White flocculent precipitates of thorium succinate are formed. The relation between the amount of sodium succinate present and the time for gel formation was determined. The gel sets only within a narrow range of stabilizing glucose solution. The gels are obtained between the pH range 2.6 and 4.5. (J.S.R.)

5327

PARAMAGNETIC RESONANCE STUDY OF IRRADIATION DAMAGE IN CRYSTALLINE CARBOHYDRATES. Dudley Williams, J. E. Geusic, M. L. Wolfrom, and Leo J. McCabe (Ohio State Univ., Columbus). Proc. Natl. Acad. Sci. 44, 1128-36(1958) Nov.

Sixteen irradiated carbohydrates were studied by observing the paramagnetic resonance spectra of powder samples of these materials. In most of the irradiated carbohydrates studied, the existence of hyperfine structure in the paramagnetic resonance spectrum suggests the general nature of the radical produced by the irradiation. The structures of the sixteen irradiated carbohydrates are given. (W.L.H.)

5328

CHEMISTRY AND SEPARATION OF ISOTOPES. G. M. Panchenko, I. A. Semiokhin and P. A. Akishin (Dept. of Physical Chemistry). Vestnik Moskov. Univ. Ser. Mat. i Mekh. 12, No. 6, 199-214(1957) (In Russian)

A review is given of work on the separation of stable isotopes, development of methods and theory of mass-spectroscopic isotope analysis, uses of labeled atoms in studies of physical and chemical processes related to isotopic separation, and studies of diffusion in liquids. (R.V.J.)

5329

THE RADIATION SYNTHESIS OF AMINO ACIDS AND RELATED COMPOUNDS. Klaus Dose and Kitty Ettre (Max-Planck-Institut für Biophysik, Frankfurt, Am Main). Z. Naturforsch. 13b, 784-8(1958) Dec. (In German)

Some radiation-chemical modes of formation of amino acids and related compounds were investigated by combination of two simpler molecule types. The radiation chemical equilibria are described. (J.S.R.)

5330
RELATION BETWEEN THE ENERGY YIELD AND THE KINETICS OF A RADIATION CHEMICAL REACTION. S. Ya. Pshezhetskiĭ and M. T. Dmitriev (Karpov Inst. of Physics and Chemistry, Moscow). Zhur. Fiz. Khim. 32, 2686-9(1958) Dec. (In Russian)

The relation between the energy yield and the kinetics of radiation-chemical reactions was examined for the basic types of kinetics and for different conditions under which the process is carried out. The dependence of the reaction yield with respect to the absorbed radiation energy on the time of exposure was shown. (tr-auth)

5331
SOME EXCHANGE REACTIONS INVESTIGATED BY MEANS OF RADIOACTIVE ISOTOPES. Henri Van Der Straaten. Thesis, University of Amsterdam, 1958.

The exchange of I_2 between organic iodides and inorganic iodine in aqueous solutions is investigated. The exchange of Cl_2 between the green chromium(III) chloride and chloride ions is presented. The exchange of Cr between chromium(II) and chromium(III) ions is discussed. (W.L.H.)

Separation Processes for Pu and U

5332 ANL-5924
Argonne National Lab., Lemont, Ill.
CHEMICAL ENGINEERING DIVISION SUMMARY REPORT [FOR] JULY, AUGUST, SEPTEMBER 1958. Dec. 1958. 184p. Contract W-31-109-eng-38. $3.00(OTS).

Fluoride Volatilization Separation Processes. A new reprocessing scheme which may be applicable to most power reactor fuels is described. The irradiated fuel is dissolved in an appropriate aqueous solution which is then calcined to a mixture of dry oxide. Fluorination of the mixture ultimately produces the hexafluorides of U and Pu, which are volatilized. This process will be called the ADF (aqueous dissolution and fluorination) process. The fluorination rates of UF_4 and PuF_4 were investigated. Since oxides, as well as fluorides, are involved in this scheme, fluorination rate studies were conducted on UO_2. The thermal decomposition of PuF_6 was investigated at 300°C by several methods that showed the reaction products to be fluorine and PuF_4. A brief study was made on the rate of fluorine consumption by Ni vessels at temperatures from 300 to 600°C. Development work has continued on the fused fluoride process for the recovery of enriched U from Zr-matrix fuel alloys. Studies of alternate methods of contacting in the fused salt fluorination step are under way. In one scheme, dropwise fluorination is carried out by spraying molten salt into a fluorine atmosphere. Another scheme involves the use of a frozen salt wall to serve as container of the fused salt during fluorination. Further corrosion data are reported on the behavior of Ni and Ni alloys in fluorinated $NaF-ZrF_4$ systems at 600°C. Liquid Metal-Fuel Reprocessing. Laboratory work to demonstrate the practicality of the fused fluoride volatility process for the LMFR fuel is being continued. The rapid extraction of U from Bi, very low in Mg concentration, was quantitatively demonstrated. Extraction of Ce from Bi, low in Mg concentration, by the molten fluoride salt has also been accomplished. The partial extraction of U and radioactive Ru from Bi with Zn was demonstrated. Bismuth pentafluoride was prepared by the direct reaction of fluorine with Bi. Fluidization Studies. Development work on the process for the recovery of U from low U-high Zr alloys (ADF process) was continued. As a part of a study to correlate U removal during fluorination with species of ZrF_4 formed at various temperatures, identification of fluid-bed dryer products was attempted. Fluorinations in the 2½-in.-diam. fluid-bed unit succeeded in removing about 99% of the U in four hours at 600°C and 12 hours at 500°C from materials prepared in a fluid-bed dryer at 300°C. Laboratory fluorination studies showed metal additives to U-Zr feed solutions had no inhibiting effect on U volatilization. In the fluid-bed waste calcination process currently under investigation, liquid radioactive wastes are spray injected into a heated fluidized bed of solid particles. A study of the factors influencing particle growth in a fluid-bed Calciner was started. Reactor Chemistry. The study of factors influencing pyrophoricity and oxidation of the reactor materials U, Zr, Th, and Pu has continued. In the U burning-curve tests, variation of the O_2 flow rate has shown a negligible effect. An ignition test has been developed in which Zr foil specimens were electrically heated to a high temperature in very short times. The oxidation of 60 binary Zr alloys was completed. A short-term study of Mg ignition has shown disagreements with the results of earlier experimenters. The experimental program to determine rates of reaction of molten reactor fuel and cladding metals with water is continuing. The relative values of the neutron-capture cross section of U^{238} for monoenergetic neutrons in the energy range 0.36 to 1.50 Mev have been determined. Chemical-Metallurgical Processing. Melt refining, liquid metal extraction, and intermetallic crystallization are now being examined as direct-cycle pyrometallurgical methods of processing nuclear reactor fuels. The joint solubility of Zr and C in molten U is under examination. Studies have continued on the pyrozinc process. A tentative phase diagram for the U-Cd systems is presented. The proposed process for recovery and purification of Pu in reactor blanket material is molten Mg extraction. Available results of experiments on this process, called the pyrozinc-magnesium process, show that Pu is well carried on a U_2Zn_{17} precipitate in accordance with previous laboratory work. Analytical Research and Services. Coprecipitation of plutonium fluoride with lanthanum fluoride was demonstrated to be a satisfactory method for separating "fissium" constituents from Pu prior to its spectrophotometric determination as the nitrate. Three indirect chemical methods for the determination of 100-microgram quantities of Pu show promise. The thermal neutron capture cross section of Cs^{137} is being determined by irradiating Cs^{137} targets and counting the Cs^{138} in the presence of the target material. (For preceding period see ANL-5896.) (W.L.H.)

5333 HW-58970
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
COMPOSITION OF SOLIDS FROM PUREX 1WW. H. H. Van Tuyl. Jan. 22, 1959. 9p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

The solids in Purex 1WW were first observed during flowsheet tests for recovery of fission products from plant wastes. Since the nature of this solid was not apparent from the flowsheet composition of 1WW, some work was performed to characterize this material. Although this work was conducted over a period of about one year, it has been subordinate to the main one of testing flowsheets for fission product recovery. The

solids have been observed in each of about six samples of plant 1WW that have been studied, and the centrifuged volume of solids has been about four percent in each case. (auth)

5334 IDO-14451

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

CONTINUOUS DISSOLVER THEORY. II. APPLICATION OF TUBE-FLOW DISSOLVER THEORY TO DATA FROM A 2-INCH, CONTINUOUS FLOODED DISSOLVER. E. E. Erickson. Jan. 14, 1959. 51p. Contract AT(10-1)-205. $1.50(OTS).

General relationships for the performance of a continuous flooded dissolver, derived earlier, were applied to available pilot plant data on the mercury-catalyzed dissolution of 2S aluminum in nitric acid for four shapes of metal elements. The relationships were based on nonmixing flow of the liquid phase, uniform metal packing characteristics, and a first-order reaction rate law. The metal elements were round rods ¼ inch in diameter and 3 inches long, 5 × 0.625 × 0.0625-inch flat plates, tubes 0.625 inch in diameter and 3 inches long with a 0.028-inch wall thickness, and the same tubes flattened so as to have about a 0.03-inch gap between sides. The dissolver was a 2-inch Pyrex column, and the effective height ranged from 8 to 10 feet. Some data were available also for the dissolution of the round rods and tubes in which the height of the bed of elements varied from about 1 to 10 feet. The average nitric acid concentration in the dissolvent feed was 5.6 molar. The data for round rods were used to determine effective reaction velocity constants for catalyst concentrations ranging from 1.5×10^{-6} to 3.75×10^{-4} molar Hg^{2+}. The general equation was used to predict the effect of the shape of metal elements, the flow rate of the dissolvent, and the height of bed of elements on the dissolution rate. The calculated rate followed the trends in the data and showed the model as expressed by the dissolver equation to give a picture generally consistent with experimental results from the pilot plant. (auth)

5335 KLX-10067

Vitro Labs., West Orange, N. J.

HOMOGENEOUS REACTOR FUEL REPROCESSING. Quarterly Progress Report [for] January 1–March 31, 1957. Vitro Job 1087. Robert A. Keeler, Charles J. Anderson, Stanley J. Klach, and Gloria K. Koenig. Apr. 31, 1957. Decl. Jan. 13, 1959. 31p. For Oak Ridge National Lab. Contract W-7405-eng-26, Subcontract No. 535. $4.80(ph OTS); $2.70(mf OTS).

An equilibrium study of I_2 between Pt pellets and H_2–O_2–steam at 350°C is described. The solubility of Kr and O_2 in homogeneous reactor fuel solution was investigated. The study of the chemical processing of underflow from the HR hydroclones for recovery of U and water continued. (T.R.H.)

5336 ORNL-2642

Oak Ridge National Lab., Tenn.

PREPARATION OF HIGH PURITY NEPTUNIUM ON MULTI-GRAM SCALE. P. M. Lantz, W. J. Martin, and G. W. Parker. Jan. 22, 1959. 25p. Contract W-7405-eng-26. $1.00(OTS).

This work was undertaken as an extension of this laboratory's effort to prepare and stock-pile multigram quantities of high-purity Np^{237} for research uses. The preliminary step in the purification of 116 grams was performed by preparing 81 liters of neptunium concentrate from several tons of Paducah Diffusion Plant Ash. The object of this investigation was of a dual nature: first, to develop a process to remove a sixty-fold thorium contamination and traces of uranium, plutonium, and the usual plant corrosion products down to less than one part per million by weight; and secondly, to improve the efficiency of the Metal Recovery Plant's neptunium purification. In connection with the second objective several aspects of the neptunium purification process were investigated, such as hydrogen peroxide stabilization of Np(V), NO_2^-–HNO_3 oxidation of Np(V) and a thorium–neptunium separation involving a low percent of tri-n-butyl phosphate. The Nethix-1 flowsheet was developed and successfully applied to the clean up of the neptunium concentrate, providing a product with less than one part per million of thorium, uranium, or plutonium. It was further determined that hydrogen peroxide is an effective stabilizer for Np(V) in the 1 M HNO_3 solutions and that the decontamination factor for thorium is approximately 20 for each stage height in a 5% TBP–HNO_3 system. (auth)

5337

THE PROCESSING OF IRRADIATED NUCLEAR FUELS. E. Pohland. Atomwirtschaft 3, 385-8(1958) Oct. (In German)

A brief survey is made of the processing of irradiated fuels. The separation methods, purification of uranium and plutonium, and the disposal of waste products are considered. The economic problems with respect to government processing plants and industrial processing plants are discussed. (J.S.R.)

CONTROLLED THERMONUCLEAR PROCESSES

5338 A/CONF.15/P/377

California. Univ., Livermore. Radiation Lab.

SUMMARY OF UCRL PYROTRON (MIRROR MACHINE) PROGRAM. R. F. Post. 39p. $0.50(OTS).

Prepared for the Second U. N. International Conference on the Peaceful Uses of Atomic Energy, 1958.

This paper combines material from two papers: Summary of UCRL Pyrotron Program, UCRL-5044, and, General Theory of Pyrotrons, UCRL-5049, submitted as papers Nos. A/CONF.15/P/333 and A/CONF.15/P/338 respectively, for the Geneva Conference.

The theory of operation of the magnetic mirror is presented, and the experimental work which was done is summarized. The principles of confinement in the mirror machine are given. In a discussion of the loss processes, nonadiabatic effects, collisional losses, ambipolar effects, and confinement of impurities are considered. The basic operations of the magnetic mirror are reviewed, and the compression equations are given. Competitions between compressional heating and collisions and between compressional heating and impurity radiation are discussed. The various methods used for injecting into a magnetic mirror consist of one or more of the following effects: time-varying fields, collisional or cooperative particle interactions, and change of charge state of the injected particle. (J.S.R.)

5339 A/CONF.15/P/1062

General Atomic Div., General Dynamics Corp., San Diego, Calif. and Texas Atomic Energy Research Foundation, Dallas.

JOINT GENERAL ATOMIC—TAERF FUSION PROGRAM. D. W. Kerst. 13p. $0.50(OTS).

Prepared for the Second U. N. International Conference on the Peaceful Uses of Atomic Energy, 1958.

A brief survey is given of the thermonuclear work being done at General Atomic and Texas Atomic Energy Research Foundation. The work is primarily based on the theoretical studies of Dr. Marshall N. Rosenbluth. (J.S.R.)

5340 A/CONF.15/P/1774
Ramo-Wooldridge Corp., Los Angeles.
RADIATION PRESSURE CONFINEMENT, THE SHOCK PINCH AND FEASIBILITY OF FUSION PROPULSION. Milton U. Clauser and E. S. Weibel. 17p. $0.50(OTS).

Prepared for the Second U. N. International Conference on the Peaceful Uses of Atomic Energy, 1958.

The research work by the Ramo-Wooldridge Corp. on two approaches to the control of the fusion reaction is described. The containment of a plasma by means of a radiation field is analyzed. The work on nonadiabatic or shock heating is described. The feasibility of thermonuclear rockets is examined. (W.D.M.)

5341 A/CONF.15/P/1860
Los Alamos Scientific Lab., N. Mex.
REVIEW OF CONTROLLED THERMONUCLEAR RESEARCH AT LOS ALAMOS FOR MID 1958. James L. Tuck. 49p. $0.50(OTS).

Prepared for the Second U. N. International Conference on the Peaceful Uses of Atomic Energy, 1958.

Studies in the field of controlled thermonuclear reactions at Los Alamos have been concerned with the pinch effect, with subsidiary investigation of hydromagnetic shocks, adiabatic compression in axial fields, and studies in rotating plasmas using radial-electric fields and axial magnetic fields. Theoretical studies in the pinch effect include the dynamic pinch, axial magnetic field stabilization, and complete stabilization with a conducting shell. (W.D.M.)

5342 A/CONF.15/P/2383
Los Alamos Scientific Lab., N. Mex.
THEORETICAL AND EXPERIMENTAL DISCUSSION OF IXION—A POSSIBLE THERMONUCLEAR DEVICE. K. Boyer, J. E. Hammel, C. L. Longmire, D. Nagle, F. L. Ribe, and W. B. Riesenfeld. 14p. $0.50(OTS).

Prepared for the Second U. N. International Conference on the Peaceful Uses of Atomic Energy, 1958.

The plasma drift in crossed (radial) electric and (axial) magnetic fields is the essential mechanism in a thermonuclear device called Ixion. A theoretical discussion is presented on the diamagnetic effects and on the mirror enhancement caused by the ion centrifugal force. The experimental results obtained from three models of Ixion are given. A diagram of Ixion-III is shown. (J.S.R.)

5343 AECD-4272
Los Alamos Scientific Lab., N. Mex.
NEUTRONS FROM HIGH CURRENT GASEOUS DISCHARGES. Robert E. Dunaway. [1957]. Decl. Aug. 21, 1957. 32p. Contract [W-7405-eng-36]. $6.30(ph OTS); $3.00(mf OTS).

Experiments on the neutrons produced in a high-current pulse discharge in deuterium are described. With 15 kv applied to a straight discharge tube 30 cm in length neutrons are produced at ~1.4 μsec after gas break-down in a pulse 0.1 μsec in length. The yield, 10^7 to 10^8 neutrons per discharge, is quite sensitive to gas purity and discharge tube wall material. The axial asymmetry in neutron energy indicates that the neutrons were produced in reactions whose center of mass moves preferentially towards the cathode. Several mechanisms for the production of these neutrons are discussed. (auth)

5344 CF-57-12-101
Oak Ridge National Lab., Tenn.
ION BEAM ENTRY CALCULATIONS. R. J. Mackin, Jr. Dec. 26, 1957. Decl. Nov. 12, 1958. 11p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

The calculations necessary to prescribe how the high-energy ion beam shall be led into DCX, without following explicitly the path of the ions through the fringing magnetic field, were made. The problem is a two-dimensional one, motion being in the midplane of the mirror configuration. Its simplification results from the circular symmetry of the field. Focusing calculations and an analysis of certain aspects of the containment problem were made using the same approach. (W.D.M.)

5345 NYO-994
Princeton Univ., N. J. Project Matterhorn.
SURVEY OF POSSIBLE PLASMA OSCILLATIONS IN THE STELLARATOR. Lyman Spitzer, Jr. July 31, 1951. Decl. Aug. 22, 1958. 14p. (PM-S-2). $3.30 (ph OTS); $2.40(mf OTS).

Low-frequency ion oscillations in a normal plasma are known to produce much more rapid diffusion across a magnetic field than would be expected from collisions in a quiescent medium. In the electric arc these oscillations have a frequency of about 10^5 per second. An analysis of these oscillations shows that under conditions anticipated in the Stellarator the frequency of these oscillations, for the wave lengths of interest, is increased by a factor of at least 10^2 as compared to normal laboratory conditions. There is some question whether oscillations will develop in a plasma where no ordered electron beams are present. A combined program of theory and observation should indicate conclusively whether or not plasma oscillations exclude the successful operation of a Stellarator. (auth)

5346 NYO-2196
Princeton Univ., N. J. Project Matterhorn.
QUARTERLY REPORT COVERING THE PERIOD OCTOBER 1—DECEMBER 31, 1958. 43p. Contract AT(30-1)-1238. (PM-Q-5). $7.80(ph OTS); $3.30(mf OTS).

Most of the experimental devices at Matterhorn were under reconstruction or in preliminary operation. B-3 has been preparing for detailed measures of pumpout with and without stabilizing windings and with programmed ohmic heating. B-65 was shut down for modifications and repairs. Etude has begun preliminary operation, and the linear plasma source, L-1, was completed; both these devices should shortly be available for basic research in plasma oscillations and instabilities, emphasizing probes. Construction continued on B-66, planned as a more powerful successor to B-65. Research has continued with B-1 and has begun with the mass spectrograph on Etude. The B-1 data have shown that admission of 0.3 percent of O_2 with H_2 gas profoundly affects the character of the discharge after repeated pulses, reducing the current in the later stage of each pulse by an order of magnitude. No such effect is produced by N_2 at any level of concentration. This phenomenon, which may have more to do with wall chemistry than with plasma physics, merits further study. The Etude mass spectrograph, which fits inside the discharge tube and analyzes ions taken directly from

the plasma, has successfully identified a wide variety of atomic and molecular ions under different discharge conditions. Fabrication of components for the C stellarator is accelerating rapidly, and it is expected that most of the components needed for first-stage operation (without divertor or ion heating) will be available this autumn. Theoretical investigation of plasma instabilities is being extended to electrostatic as well as hydromagnetic modes. Accumulating evidence suggests that electrostatic instabilities may be important in stellarator discharges. (auth)

5347 NYO-2536
New York Univ., New York. Atomic Energy Commission Computing and Applied Mathematics Center.
THEORY OF CUSPED GEOMETRIES. II. PARTICLE LOSSES. Jerome Berkowitz. Jan. 6, 1959. 21p. Contract AT(30-1)-1480. $3.30(ph OTS); $2.40(mf OTS).

Some results of the Theory of Cusped Geometries, I. General Survey, NYO-7969, by Harold Grad are extended. The computation of particle losses through a line cusp is performed under the assumption that there is a good approximation to a sharp boundary separating the field-free plasma from the vacuum magnetic field. (W.D.M.)

5348 NYO-6040
Princeton Univ., N. J. Project Matterhorn.
DESIGN AND CONSTRUCTION OF MODEL A STELLARATOR. Clodius H. Willis. Mar. 17, 1953. Decl. Aug. 22, 1958. 18p. Contract AT(30-1)-1238. (PM-S-7). $3.30(ph OTS); $2.40(mf OTS).

The design and construction of the model A Stellarator which is to be used for the study of gas discharge phenomena are described. The functions of the machine are to provide a vacuum chamber for enclosing a gas at low pressure, produce an axial magnetic field for enclosing the plasma, and give a high-frequency axial electric field parallel to the guiding magnetic field. The vacuum enclosure, guiding magnetic field, and accelerating voltage are discussed. (W.D.M.)

5349 NYO-6047
Princeton Univ., N. J. Project Matterhorn.
PROBLEMS OF THE STELLARATOR AS A USEFUL POWER SOURCE. Lyman Spitzer, Jr., Donald J. Grove, Woodrow E. Johnson, Lewi Tonks, and Willem F. Westendorp. Aug. 1, 1954. Decl. Jan. 28, 1959. 278p. Contract AT(30-1)-1238. (PM-S-14). $43.20(ph OTS); $11.10(mf OTS).

Preliminary consideration is given to the problems involved in generating useful electric power with a stellarator. The analyses are focussed on a proposed machine with a reaction tube of diameter 3 to 4 ft, with an axial length of 540 ft measured around the figure 8, and with a surrounding blanket 2 ft thick composed of steel pipes containing water and molten lithium. (W.D.M.)

5350 NYO-6360
Princeton Univ., N. J. Project Matterhorn.
SEVENTH PERIODIC STATUS REPORT. Sept. 1, 1954. Decl. Aug. 22, 1958. 18p. Contract AT(30-1)-1238. (PM-129). $3.30(ph OTS); $2.40(mf OTS).

Experimental work on the Model B-1 stellarator indicates that the discharges behave about as expected, when the coils are properly aligned. Lack of rigidity in the coil support system prevented as yet, any extensive physical experimentation. In place of adding magnetic pumping to Model B-1, a separate Model B-2 stellarator is being built, to test whether thermonuclear temperature can be achieved by means of magnetic pumping. An engineering study of the problems involved in constructing a full-scale stellarator gives reason to expect that if confinement and heating are adequate, the stellarator will prove to be an economically attractive source of power. (For preceding period see NYO-6358.) (auth)

5351 NYO-7890
Princeton Univ., N. J. Project Matterhorn.
MAGNETIC PUMPING CALCULATIONS. Technical Memorandum No. 43. M. S. Jones, Jr., J. E. Rizzo, Jr., and E. B. Meservey. Apr. 10, 1957. Decl. Aug. 21, 1958. 8p. $1.80(ph OTS); $1.80(mf OTS).

Computational aids to assist in the application of the Berger-Newcomb theory are presented. Calculations are simplified so that the effects of variations in the basic parameters of the original theory may be easily found. Emphasis is placed on the amount of power that is supposed to be delivered to the plasma, rather than the e-folding times for temperature. Collisional and transit time heating approximations are considered. (J.R.D.)

5352 NYO-7904
Princeton Univ., N. J. Project Matterhorn.
STABILITY OF HYDROMAGNETIC EQUILIBRIA WITH HELICALLY INVARIANT FIELDS. Work Completed: November 30, 1956. J. L. Johnson, C. R. Oberman, R. M. Kulsrud, and E. A. Frieman. Aug. 1, 1957. 185p. Contract AT(30-1)-1238. (PM-S-34). $3.00 (OTS).

An equilibrium situation is obtained for the case of a uniform axial magnetic field with the addition of a superposition of weak helically invariant fields, a field due to a small axial current, and a field due to a low-pressure infinitely conducting plasma. The energy principal is used to determine conditions for the stability of this equilibrium. Two basic results are obtained: (a) the conditions for the stability of a system which consists of a superposition of helical fields and "bulge" fields ($l = 0$) are determined; and (b) it is shown that the addition of a helical field with $l = 3$ can produce complete hydromagnetic stability when an axial current is flowing and can also increase the Kruskal limit on the current for the $m = 1$ mode. (auth)

5353 NYO-8051
Princeton Univ., N. J. Project Matterhorn.
ON VACUUM MAGNETIC FIELDS IN A TORUS WITH MULTIPOLAR WINDINGS. John L. Johnson. Aug. 27, 1958. 53p. (PM-S-37). $1.50(OTS).

Magnetic fields, surfaces, and lines of force are obtained for a toroidal system on which multipolar fields are applied. The results are applied to the Model C stellarator in order to estimate the shift of the magnetic surfaces which one could expect. (auth)

5354 ORNL-1890
Oak Ridge National Lab., Tenn.
DIFFUSION OF IONS IN A PLASMA ACROSS A MAGNETIC FIELD. Albert Simon and Rodger V. Neidigh. July 11, 1955. Decl. Oct. 14, 1955. 29p. Contract W-7405-eng-26. $4.80(ph OTS); $2.70(mf OTS).

A theoretical and experimental investigation of the coefficient for diffusion of ions across a magnetic field is described. The resultant diffusion coefficient is found to vary inversely as the square of the magnetic field strength, in accord with the usual collison-diffusion theory. The magnitude of the coefficient is much larger

(×700) than the coefficient predicted by the usual ambipolar diffusion theory. This discrepancy is resolved by showing that diffusion across a magnetic field is not ambipolar in character in most arc experiments. The final experimental and theoretical values are in good agreement, and it is unnecessary to postulate any additional diffusion mechanisms, such as plasma oscillations. (auth)

5355 ORNL-2288
Oak Ridge National Lab., Tenn.
THE EFFECT OF A PRESSURE GRADIENT ON A MAGNETICALLY COLLIMATED ARC. Rodger V. Neidigh and Charles H. Weaver. June 25, 1957. Decl. Nov. 12, 1958. 23p. Contract W-7405-eng-26. $4.80 (ph OTS); $2.70(mf OTS).

The experimental observations associated with an unusual gaseous discharge phenomenon are described. Electrons accelerated from the heated cathode are observed to possess an energy spread much greater than that observed in the usual arc. Ion energies increase linearly with hot-cathode bias, to the limit of its supply. Either constant or time-varying electric fields which exist in the central arc column accelerate some ions to at least twice the cathode bias. The results are entirely reproducible. A simplified schematic diagram of the apparatus used is shown. (W.D.M.)

5356 ORNL-2420
Oak Ridge National Lab., Tenn.
DISSOCIATION OF H_2^+ AND D_2^+ BY A VACUUM CARBON ARC. C. F. Barnett, R. J. Mackin, Jr., and J. A. Ray. Dec. 27, 1957. Decl. Nov. 12, 1958. 18p. Contract W-7405-eng-26. $3.30(ph OTS); $2.40(mf OTS).

The efficiency of the carbon arc to dissociate diatomic hydrogen and deuterium ions was measured for ion energies of 600 kev. The measured dissociation efficiency for hydrogen was $10.6^{+2.4}_{-0.9}$% and for deuterium $16.4^{+1.6}_{-1.2}$%. It was found that the dissociation was dependent upon the electrode geometry, distance of dissociation from anode, and measured arc current. (auth)

5357 ORNL-2552
Oak Ridge National Lab., Tenn.
ENERGY TRANSFER TO COLD ELECTRONS IN DCX. T. K. Fowler and A. Simon. Aug. 8, 1958. Decl. Nov. 12, 1958. 14p. Contract W-7405-eng-26. $3.30 (ph OTS); $2.40(mf OTS).

Heat loss to cold electrons streaming through the plasma was included in the calculation of the steady-state operating conditions of DCX. Even with the pessimistic assumption that all these electrons are heated up to the plasma mean electron energy before escaping, it is found that appreciable ion temperatures can be maintained in the presence of electron streaming at a rate as much as twenty times the input rate of hot ions feeding the plasma. The effect of ion temperatures of cold electrons in the arc was estimated. The results are quite sensitive to uncertainties in arc electron density and temperature and to the uncertain fraction of its lifetime an ion spends in the arc. (auth)

5358 TID-5447
Carnegie Inst. of Tech., Pittsburgh.
REPORT ON PROJECT SHERWOOD COVERING A STUDY PERIOD FROM AUGUST 1, 1955 THROUGH APRIL 30, 1956. E. Creutz. May 1, 1956. Decl. Jan. 23, 1959. 74p. $12.30(ph OTS); $4.50(mf OTS).

The basic idea behind Project Sherwood is given, and the status of the project is summarized in reports of developments in stellarators, magnetic mirrors, heating, sources, vacuum, special devices and plasma, plasma theory, economics, and cost of the program. (T.R.H.)

5359 TID-7503
Division of Research. Controlled Thermonuclear Branch, AEC.
CONFERENCE ON CONTROLLED THERMONUCLEAR REACTIONS, HELD AT PRINCETON UNIVERSITY, OCTOBER 17-20, 1955. Amasa Bishop, comp. Feb. 1956. Decl. Jan. 23, 1959. 542p. $7.00(OTS).

Papers are presented on the status of the Stellarator, magnetic mirror, and pinch programs, stability considerations, alternative approaches, ion sources, plasma diagnostics, and various related topics. (W.D.M.)

5360 TID-7520
Division of Research. Controlled Thermonuclear Branch, AEC.
CONFERENCE ON CONTROLLED THERMONUCLEAR REACTIONS, JUNE 4-7, 1956, GATLINBURG, TENNESSEE. Sept. 1956. Decl. Jan. 23, 1959. (Issued in two parts: (Pt. 1), 326p. and (Pt. 2), 319p.). $112.70(ph OTS); $11.10(mf OTS).

Sixty-five papers related to the production of controlled thermonuclear reactions are presented. Recent developments in the production and stabilization of pinch and cusped geometries and the development of stellarator and magnetic mirror machines are reported. Theoretical and experimental studies of plasma stability, ion sources, and plasma diagnostics are included. (D.E.B.)

5361 TID-7536(Pt.2)
Division of Research. Controlled Thermonuclear Branch, AEC.
CONTROLLED THERMONUCLEAR REACTIONS. A Conference Held at Berkeley, California, February 20-23, 1957. Sept. 1957. Decl. Feb. 19, 1959. (Issued in two books: (Bk.1), 232p. and (Bk.2), 321p.). $91.80(ph OTS); $11.10(mf OTS).

Sixty-two papers are included which treat specific phases of British and U. S. thermonuclear research projects. The various machines being developed are described, and many problems associated with plasma establishment and confinement are discussed. (D.E.B.)

5362 TID-7558
Division of Research. Controlled Thermonuclear Branch, AEC.
PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 534p. $4.75(OTS).

This report is a compilation of papers presented at a conference on controlled thermonuclear reactions. The conference was attended by AEC personnel, personnel of AEC contractors, representatives of other agencies of the United States Government, and representatives of the UKAEA. The primary purpose of the conference was interchange of information between AEC and AEC contractors and briefing of the Sherwood Steering Committee. General reviews and program status are given for the various research labs in the U.S. and U.K. (W.D.M.)

5363 TID-7558(p.1-5)
Princeton Univ., N. J. Project Matterhorn.
STATUS OF THE STELLARATOR PROGRAM. Lyman Spitzer, Jr. p.1-5 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY,

WASHINGTON, D. C., FEBRUARY 3-5, 1958. 5p. (PM-335).

The Matterhorn research effort is directed towards two main goals. Firstly, there is the practical objective of heating a plasma to the highest possible temperatures and confining it by means of a magnetic field. This is clearly the central purpose of the Princeton thermonuclear program at the present time and must be achieved if a thermonuclear reactor is to be possible. Secondly, there is the scientific objective of understanding the complex phenomena which occur in a fully ionized gas. A broad program of plasma physics, which is required for such an understanding, may be of vital importance in achieving the practical objective of heating and confinement. The term "cooperative phenomena" has been applied to those processes which involve temporal oscillations, or fluctuations, and which depend for their existence on the interaction of many particles with each other, through electric forces. The British observations on Zeta indicate that cooperative phenomena of some unexplored type must be responsible for the acceleration of the positive ions, while the experience at Princeton indicates that such phenomena are responsible for a marked impairment of magnetic confinement in certain instances. An understanding of these processes might indicate how such effects can be exploited or controlled for practical purposes. Progress made toward these two goals within the past twelve months is described. (auth)

5364 TID-7558(p.6-7)
Oak Ridge National Lab., Tenn.
STATUS OF SHERWOOD AT THE OAK RIDGE NATIONAL LABORATORY. P. R. Bell. p.6-7 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 2p. (CF-58-2-90).

The ORNL program is directed toward obtaining a plasma at thermonuclear temperatures by the injection of high-energy ions. The program is centered around DCX, and a major part of the experimental work is directed toward the solution of problems related to DCX or to the larger machine which must follow. (W.D.M.)

5365 TID-7558(p.8-10)
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
RECENT EXPERIMENTS WITH ZETA. G. N. Harding. p.8-10 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 3p.

Recent measurements with ZETA on pressure balance and neutron origin are briefly reported. Instantaneous measurements of B_θ and B_z were obtained with a multiple-coil magnetic probe enclosed in a one-inch-diameter quartz tube and inserted radially into the discharge. The spatial distribution of the source of neutrons was investigated by scanning across a minor diameter of the torus with a large shielded neutron counter having an angular acceptance of $\pm 5°$. (W.D.M.)

5366 TID-7558(p.12-16)
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
THE SCALING LAWS FOR THE STABILISED PINCH. R. J. Bickerton and H. London. p.12-16 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 5p.

The scaling laws for the stabilized pinch are derived. The recent results obtained with such discharges are considered in the light of these relations. (auth)

5367 TID-7558(p.17-25)
Los Alamos Scientific Lab., N. Mex.
NEUTRONS FROM A STABILIZED TOROIDAL PINCH. J. Honsaker, H. Karr, J. Osher, J. Phillips, and J. Tuck. p.17-25 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 9p.

A temperature of 600 ev would be consistent with the observed yield of neutrons, and the pressure balance equations would support this. Magnetic probes indicate that the pinch undulates as a whole with an amplitude of about 2 mm. The diminution in neutron yield after the initial burst is a matter for concern and finds an explanation in terms of cooling by the influx of impurities. It is concluded that the fringe of thermonuclear temperatures (~500 ev) is being approached. (W.D.M.)

5368 TID-7558(p.26-35)
Los Alamos Scientific Lab., N. Mex.
COLUMBUS S-4 EXPERIMENTS. L. C. Burkhardt and R. H. Lovberg. p.26-35 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 10p.

Experiments have been performed employing a B_z-stabilized linear discharge in a ceramic tube of dimensions larger than those of previously reported systems. Pronounced improvement in discharge contamination was observed, and a system of circulating currents was observed within the tube, even when the input current was zero. Pressure balance calculations indicated a probable central temperature in excess of 300 ev. Neutron output was observed over a 5 microsecond interval centered on the discharge current maximum. (auth)

5369 TID-7558(p.36-45)
Los Alamos Scientific Lab., N. Mex.
STABILITY OF A LINEAR PINCH WITH CONTINUOUS B-FIELD. Bergen R. Suydam. p.36-45 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 10p. (T-988).

This report continues the study initiated in LA-2149 of the stability of a linear, axisymmetric pinch. By appealing to a heuristically derived principle, it has proved possible to derive stability conditions from a study of the Euler-Lagrange equation of a variational principle. The results of this report are thus much stronger than and completely supersede those of LA-2149. (auth)

5370 TID-7558(p.46-55)
Los Alamos Scientific Lab., N. Mex.
THE ISOLATION OF HOT PLASMAS FROM MATERIAL WALLS BY THE USE OF INTERVENING PLASMAS. Harry Dreicer. p.46-55 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 10p. (P-14-20).

A new concept in the isolation of hot plasmas from

wall-emitted impurities is discussed. Some qualitative calculations are made, and several conceptual designs are briefly described. Preliminary experimental data obtained on a linear system are presented. (auth)

5371 TID-7558(p.56-66)
Los Alamos Scientific Lab., N. Mex.
LOW GRADIENT PINCH PROGRAM. G. A. Sawyer and T. F. Stratton. p.56-66 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABOPATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 11p. (P-15-21).

Stadies were made of high-current pinched discharges in deuterium gas. Voltage gradients were one to five volts per cm, initial gas pressures were 0.1 to 10 microns Hg, and axial magnetic fields were 500 gauss maximum. A metal-walled discharge tube of 6 in. diameter was investigated both in a linear assembly 20 ft long and as an electrodeless, endless racetrack having 5-ft-long straight sides and elbows at the corners. The discharge displayed a turbulent character, striking the walls frequently. At discharge currents less than 10 ka, a regular oscillation of the discharge was observed. Excellent reproducibility of the discharge permitted the measurement of complete magnetic field distributions as a function of time and space, from which complete current distributions were derived. The current distribution was found to have a helical notch of reduced current which rotated with uniform angular velocity. A larger linear discharge tube, 36 in. diameter, and 12 ft long is being assembled to permit the study of low-gradient pinched discharges in larger systems. (auth)

5372 TID-7558(p.67-8)
Los Alamos Scientific Lab., N. Mex.
THE STATIC PINCH. Conrad L. Longmire. p.67-8 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 2p. (PT-47).

In a pinch, the outward diffusion of plasma due to collisions can be balanced by the inward drift resulting from $\vec{E} \times \vec{B}$, where $\vec{E}$ is the applied electric field and $\vec{B}$ the magnetic field. From the equation expressing the balance of these two effects, and from the pressure balance equation, one can deduce the so-called perpendicular conductivity, which turns out to be about one-half of the classical (parallel) conductivity. This result has been applied to the problem of a static pinch under the assumptions that there is a uniform applied longitudinal magnetic field, the plasma is isothermal, and the solution depends only on the radial coordinate. (auth)

5373 TID-7558(p.70)
California. Univ., Livermore. Radiation Lab.
STABILITY OF A TOROIDAL PINCH. M. H. Mittleman and W. A. Newcomb. p.70 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 1p. (UCRL-5096).

A calculation is in progress to obtain a stability criterion for the toroidal pinch analogous to the Rosenbluth criterion for a linear pinch. The basic equations are the same as in the Rosenbluth calculation, i.e., the magnetohydrodynamic equations with a scalar plasma pressure. The plasma pressure is governed by the adiabatic law, PV^{γ} = constant, but the stability criterion is independent of γ; the results are therefore unaffected by treating the plasma as an incompressible fluid ($\gamma = \infty$). The space outside the plasma can be treated either as a vacuum or as a pressureless plasma. This is a special property of the toroidal geometry; ordinarily a pressureless plasma has a stabilizing effect as compared with a vacuum. Although the statements are exact consequences of the magnetohydrodynamic equations, the stability criterion itself is found by an expansion in powers of the ratio of the minor and major radii of the torus. The zero-order results are, of course, those obtained by Rosenbluth for the linear pinch. The modifications produced in his results by the toroidal geometry are obtained by going to second order in the expansion parameter, because it follows from symmetry considerations that there is no effect in first order. (auth)

5374 TID-7558(p.71-84)
California. Univ., Livermore. Radiation Lab.
EXTERNAL CONDUCTIVITY THEORY OF STABILIZED PINCH FORMATION. S. A. Colgate, J. P. Ferguson, and H. P. Furth. p.71-84 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 14p. $0.75(OTS).

Also issued separately as UCRL-5086.

External to a pinch, there generally will exist a pressureless plasma of a density sufficient to make its electrical conductivity comparable with that of the pinch proper. The recognition of this fact has led to a more complete understanding of boundary layer formation in the stabilized pinch. The sharpness of the boundary layer is seen to be limited by two entirely independent factors: the resistive diffusion process, and the programming of magnetic field boundary values at the insulating wall. A mathematical method is developed to describe the entrapment and compression of magnetic field distributions in infinite conductivity plasma. Experimental evidence is presented which documents the basic concepts of the external conductivity theory. (auth)

5375 TID-7558(p.85-97)
California. Univ., Livermore. Radiation Lab.
NONTHERMONUCLEAR NEUTRONS FROM THE STABILIZED PINCH. S. A. Colgate, John Ferguson, and H. P. Furth. p.85-97 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 13p. (UCRL-5118).

Some general scaling laws are derived for the characteristic parameters of various neutron-producing stabilized pinch devices. An attempt is made to fit some theoretical mechanisms of neutron-production into the framework of the general scaling laws. The hypothesis of thermonuclear origin is found poorly consistent with much of the experimental data. The degree of plasma turbulence required to give neutrons by the Fermi mechanism is estimated, and found reasonable. Operation of Gamma Pinch is briefly described and an interesting correlation of neutron yield with H_z spatial distribution is pointed out. (auth)

5376 TID-7558(p.98-117)
California. Univ., Livermore. Radiation Lab.
THE SCREW DYNAMIC PINCH. S. A. Colgate, H. P. Furth, and R. E. Wright. p.98-117 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH

LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 20p. (UCRL-5099).

The screw dynamic pinch is a dynamic pinch in which a small axial field component is trapped external to the main plasma column, and compressed to high values (comparable to the primary pinch field) by entrapment in the pressureless conducting plasma surrounding the pinch. The effect of the axial external field is to suppress the m = 0 sausage instability and enhance the m = 1 helical mode. The primary object is to achieve slightly longer containment time before instability break-up, and to suppress the large "fake" neutron yield from the m = 0 mode, thus making a true thermonuclear yield easier to prove. An experiment has confirmed the theory of entrapment and instability growth and has given a small neutron yield correlated to the m = 1 helical mode growth. It is unlikely that the yield obtained is thermonuclear, but the advance in our understanding of pinch phenomena has been substantial. (auth)

5377 TID-7558(p.120-39)
California. Univ., Berkeley. Radiation Lab.
THE TRAPPING OF CHARGED PARTICLES IN AXIALLY SYMMETRICAL SYSTEMS OF ELECTRIC AND MAGNETIC FIELDS. J. D. Gow, L. Ruby, L. Smith, and J. M. Wilcox. p.120-39 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 20p. (UCRL-8156).

An electron-trapping geometry is described which was accidentally observed in the course of a PIG ion-source development program. Some possible applications to the Sherwood program are discussed. The anode sheath formed at the central rod of a magnetronlike geometry is measured and analyzed. (auth)

5378 TID-7558(p.140-67)
Los Alamos Scientific Lab., N. Mex.
EXPERIMENTAL AND THEORETICAL DISCUSSION OF IXION. K. Boyer, J. E. Hammel, C. L. Longmire, D. Nagle, F. L. Ribe, and W. B. Riesenfeld. p.140-67 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 28p. (P-15-20).

The plasma drift in crossed electric and magnetic fields is the essential mechanism in a thermonuclear device called Ixion. Ixion utilizes an axially symmetric configuration of magnetic and electric fields consisting of an approximately radial electric field such as may be produced by concentric cylindrical electrodes, and an approximately axial magnetic field whose intensity increases with distance away from the median plane (magnetic-mirror geometry). The results of various theoretical studies on the behavior of Ixion are presented, as well as a summary of experimental results. (auth)

5379 TID-7558(p.168-83)
California. Univ., Livermore. Radiation Lab.
THE FELIX EXPERIMENT. F. S. Eby and C. C. Damm. p.168-83 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 16p. (UCRL-5106).

The Felix experiment constitutes an investigation of the possibility of building up an energetic plasma by the trapping of pre-accelerated ions in a magnetic bottle. The injection problem and possible loss mechanisms are discussed, and the experimental results obtained thus far are reported. (auth)

5380 TID-7558(p.184-94)
California. Univ., Livermore. Radiation Lab.
GENERAL EXPERIMENTAL RESULTS (TABLE TOP RESULTS). F. C. Ford and S. G. Zizzo. p.184-94 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 11p. (UCRL-5112).

The behavior of a magnetically compressed and heated plasma in mirror machine geometry has been studied using strong fields and pulsed injection. Compression, heating, stability, density, and containment times are some of the fundamental categories where data have been obtained. Techniques that have been applied with some success include probes, nuclear plates, phosphorescent screens, scintillation fluors, μ-wave interferometry and noise, and optical spectroscopy. The composite picture of the plasma behavior is given in terms of the measurements made by these techniques. (auth)

5381 TID-7558(p.195-204)
California. Univ., Berkeley. Radiation Lab.
ELECTRON ENERGY DISTRIBUTION. R. E. Ellis and N. L. Parker. p.195-204 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 10p. (UCRL-5117).

Measurements of the electron energy distribution of plasma electrons escaping through the loss cone of one of the mirrors of the Table Top device have been made with a plastic fluor scintillator detector. By differentiating the smooth curves drawn through the experimental points, information concerning $N(E_0)$, the number of electrons per unit energy interval at energy E_0, as a function of time is obtained. (auth)

5382 TID-7558(p.205-10)
California. Univ., Livermore. Radiation Lab.
MICROWAVE RADIOMETRY MEASUREMENTS ON THE TABLE TOP EXPERIMENT. Charles B. Wharton. p.205-10 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 6p. (UCRL-5129).

A study of the microwave radiation from a hot plasma at frequencies in the vicinity of the electron gyrofrequency is described. Using electron energy distributions obtained from another experiment and absorption cross sections obtained by transmission experiments, the case for local equilibrium is established, leading to the conclusion that the calibrated radiation intensities observed, at gyroresonance are a true indication of electron kinetic temperatures. The temperatures obtained by this means are in close agreement with those obtained by x-ray studies and by energy-range experiments using absorbers. Some information on the position of the radiating front was obtained by comparing the magnetic field strength at which radiation occurs with the field strength at the center and in the mirrors. (auth)

5383 TID-7558(p.211-18)
California. Univ., Livermore. Radiation Lab.
TOY TOP EXPERIMENT. F. H. Coensgen, W. F. Cummins, and A. E. Sherman. p.211-18 [of] PAPERS

PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 8p. (UCRL-5140).

The first successful measurements of ion energies of a plasma that has been magnetically compressed are described. The analyzing system can also separate light ions such as D^+ and H^+ from heavier ions C^{2+}, C^+, O^+, etc. (auth)

5384 TID-7558(p.219-21)
California. Univ., Livermore. Radiation Lab.
SUMMARY AND INTERPRETATION OF PYROTRON EXPERIMENTAL RESULTS. Richard F. Post. p.219-21 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 3p. (UCRL-5147).

The various magnetic mirror experiments of the Pyrotron Program are collectively showing a behavior which seems on the whole consistent with a picture of a stably confined plasma behaving in accordance with simple adiabatic theory. Heating effects on both electrons and ions have been quantitatively demonstrated, apparently indicating Maxwellized electron distributions with temperatures of about 20 kev, and, in separate experiments, ion energy distributions with mean energies approaching one kilovolt. Values of β of the confined plasma have been determined lying in the range of 1 to possibly as high as 20 percent. Microwave noise measurements appear to confirm both the electron temperature and the spatial compression effects found by other methods. (auth)

5385 TID-7558(p.222-6)
Oak Ridge National Lab., Tenn.
DISSOCIATION OF H_2^+ AND D_2^+ BY THE VACUUM CARBON ARC. C. F. Barnett. p.222-6 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 5p. (CF-58-2-85).

At the Berkeley meeting the cross section for dissociation of the diatomic hydrogen ions by impact with a gas atom was reported. In the energy interval between 500 kev and 2.25 Mev it was found that the cross section had a 1/v dependence for light gases and a very small velocity dependence for heavier gases. The predicted theoretical slope is $1/v^2$. Since no adequate explanation has been advanced for the high efficiency of the carbon arc to dissociate H_2^+ at energies of 30 kev, it was necessary to extend the dissociation efficiency measurements to particle energies up to kev. With the dissociation efficiency of the carbon arc and the cross section for various loss processes known, a calculation may be made to determine the rate of entrapment of D^+ in DCX. (auth)

5386 TID-7558(p.227-35)
Oak Ridge National Lab., Tenn.
DCX STATUS. J. S. Luce. p.227-35 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C. FEBRUARY 3-5, 1958. 9p. (CF-58-2-89).

The cross section for D_2^+ breakup in the carbon arc has been measured. The charge exchange cross section for 300-kev atomic ions was measured. DCX was constructed in July 1957. A 600-kev D_2^+ beam was injected through the fringing field of DCX and brought to a focus at the arc. About 25 to 40% conversion of these molecular ions to the atomic state was achieved. The inner high vacuum liner of DCX was evacuated to a pressure of 3×10^{-6} mm Hg and the problem of running the arc through two vacuum systems and two sets of baffles was solved. (W.D.M.)

5387 TID-7558(p.236-9)
Oak Ridge National Lab., Tenn.
DCX THEORY. Albert Simon. p.236-9 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 4p. (CF-58-2-91).

In a device such as DCX the problems involved in obtaining a hot plasma are very different from those in other Sherwood machines with the partial exception of the Livermore mirror devices. The ions are injected steadily with high energy and in an organized fashion, but are prevented from randomizing and going into a useful plasma by two competing processes. The first, and largest of these, is charge exchange with the neutral gas, while the second is energy loss to cold electrons and ions in the plasma. A large part of the theoretical investigations have been concerned with determining the conditions which must be met in overcoming these obstacles. (auth)

5388 TID-7558(p.240-5)
Princeton Univ., N. J. Project Matterhorn.
HYDROGEN DISCHARGES IN THE B-1 STELLARATOR. W. Bernstein, A. Z. Kranz, and M. A. Heald. p.240-5 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 6p. (PM-339).

The characteristics of hydrogen and deuterium discharges in the baked B-1 Stellarator have been observed. Hydrogen and deuterium discharges were indistinguishable within the experimental error. Striking similarities and differences are observed when hydrogen discharges are compared with those in helium. Wall phenomena still greatly influence the discharge characteristics in hydrogen and helium, even though an ultra high vacuum system is used. (auth)

5389 TID-7558(p.246-53)
Princeton Univ., N. J. Project Matterhorn.
RUNAWAY ELECTRONS AND COOPERATIVE PHENOMENA IN BAKED B-1 STELLARATOR DISCHARGES. A. Z. Kranz, W. Bernstein, and M. A. Heald. p.246-53 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 8p. (PM-340).

Evidence for the existence of coöperative phenomena in baked B-1 Stellarator discharges is presented. This includes correlated emission of x rays, abrupt start and end of x-ray emission, microwave noise observations, and abrupt changes in current. It is postulated that runaway electrons can be thrown back into the plasma, accompanied by re-excitation and ionization of the gas. (auth)

5390 TID-7558(p.254-63)
Princeton Univ., N. J. Project Matterhorn.
PRELIMINARY OPERATION OF THE B3 STELLARATOR. J. G. Gorman, R. A. Ellis, Jr., E. B. Meservey, R. W. Motley, and J. E. Rizzo. p.254-63 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL

RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 10p. (PM-345).

The new B3 Stellarator is described briefly. The location of magnetic surfaces in the machine is found experimentally to agree very well with the analogue computed design; an aperture 50% greater than that in the B1 machine is realized. Preliminary observations on discharges in helium are in general agreement with those of the B1 machine. Confining fields up to 53 kilogauss were used. Results from diagnostic techniques new to baked stellarators are presented, including 4 mm microwave phase shift equipment, a 10 kc resistance measuring device, and a system for adding controlled amounts of impurities to the discharge. (auth)

5391 TID-7558(p.264-78)
Princeton Univ., N. J. Project Matterhorn.
EXPERIMENTS ON ION CYCLOTRON RESONANCE. T. H. Stix. p.264-78 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 15p. (PM-342).

Theoretical calculations have indicated that an attractive possibility for heating the ions of a plasma directly, swiftly, and efficiently is to feed energy into ion cyclotron waves and cause this wave energy to thermalize. Experiments at the milliwatt power level verify the existence of a resonance in a helium plasma at the cyclotron frequency of the doubly-charged helium ion. The variation of the plasma loading with magnetic field strength is markedly asymmetrical, in qualitative agreement with the theory of ion cyclotron wave generation. The observed plasma loading indicates an efficiency of power transfer between the r-f power generator and the plasma of around 70%. The calculated value is around 95%. (auth)

5392 TID-7558(p.279-85)
Oak Ridge National Lab., Tenn.
DESIGN AND ERECTION OF DCX. H. C. Hoy. p.279-85 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 7p. (CF-58-2-81).

A set of magnet coils was designed to give a mirror ratio of 2:1 with a field of 8000 gauss in the median plane of the two coils. Working from the dimensions of the coil and its containing can size, a vacuum tank and liner were designed. Pumping, cooling, mounts for the carbon electrodes, and associated equipment were designed and fabricated. The various improvements and modifications made on the original layout are described. (W.D.M.)

5393 TID-7558(p.286-9)
Oak Ridge National Lab., Tenn.
FUTURE PLANS. E. D. Shipley. p.286-9 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 4p. (CF-58-2-82).

Future plans are dictated by the recipe for establishing a hot plasma in a large system. The proposed scheme comprises two stages. In the first stage, a subvolume of the plasma cavity is partially filled with a hot plasma by use of high-energy molecular-ion injection and trapping. Compression then enables this subplasma to contain its own reaction products and become self-sustaining. The second stage involves injection of cold fuel and expansion of the subvolume. (auth)

5394 TID-7558(p.291-300)
Naval Research Lab., Washington, D. C.
HIGH COMPRESSION EXPERIMENTS. Alan C. Kolb. p.291-300 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 10p.

A high-energy compression experiment is described. Fields of the order 700,000 gauss, generated by an 8×10^6 amp discharge, are possible. The results of preliminary experiments are discussed. (auth)

5395 TID-7558(p.301-4)
Los Alamos Scientific Lab., N. Mex.
ACCELERATION OF PLASMA INTO VACUUM. John Marshall. p.301-4 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 4p. (P-15-22).

Apparatus has been developed capable of injecting high-speed jets of plasma into vacuum. A fast acting mechanical valve admits deuterium to a vacuum system such that high pressures exist momentarily near the valve while the rest of the system is still under a good vacuum. Shock waves generated electromagnetically in the high-pressure region produce plasma blow-off into the vacuum. An injector of this type has been applied to Ixion III. (auth)

5396 TID-7558(p.305-6)
Los Alamos Scientific Lab., N. Mex.
SCYLLA. William C. Elmore, Edward M. Little, and Warren E. Quinn. p.305-6 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 2p. (P-15-23).

A rapidly increasing axial magnetic field produced by a pair of coaxial loops is used to shock-heat and then to compress a small volume of deuterium plasma. The simple arrangement described produces a burst of neutrons which occur in an interval in time encompassing the instant of peak compression. (auth)

5397 TID-7558(p.307-10)
New York Univ., New York. Atomic Energy Commission Computing and Applied Mathematics Center.
WAVE IN PLASMA IN MAGNETIC FIELD CAUSED BY APPLICATION OF CROSSED ELECTRIC FIELD. C. S. Gardner. p.307-10 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 4p.

The problem considered is to describe the wave generated by applying a crossed electric field to a plasma in equilibrium in a uniform magnetic field. A solution is obtained for a simple plasma model by using linearized small-disturbance equations. The solution is a wave travelling at the Alfven speed. The wave front broadens with time, its width being proportional to the cube root of time. (auth)

5398 TID-7558(p.311-12)
New York Univ., New York. Atomic Energy Commission Computing and Applied Mathematics Center.
STEADY STATE SHOCK MODEL. Cathleen S. Morawetz. p.311-15 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 2p.

A method is presented for studying the internal structure of a magnetohydrodynamic shock based on the fact that the mass of the electron is small compared to the mass of the ion. Three cases are discussed which lead to (a) a solitary wave and no shock, (b) half of a solitary wave followed by an undamped oscillation, and (c) a solitary wave followed by the beginning of a damped oscillation. The change in the Boltzmann distribution for the ions is discussed. (auth)

5399 TID-7558(p.313-15)
Argonne National Lab., Lemont, Ill.
RADIATION DAMAGE EFFECTS IN THERMONUCLEAR REACTORS. Henry A. Kierstead. p.313-15 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 3p.

The radiation damage problems in the Model D Stellarator are dealt with specifically. It is anticipated that radiation damage effects in other types of fusion reactors will be similar. The Model D is intended to produce 5×10^6 watts of power, primarily from the DT reaction. The primary flux of 14-Mev neutrons at the wall of the reaction tube is 8×10^{14} n/cm^2/sec. This flux is moderated and attenuated by a 2-ft blanket consisting of ~45% Fe, 25% Li, 25% H_2O, and 5% Be. The flux effects in the reaction tube and blanket, divertors, and magnets are discussed. (W.D.M.)

5400 TID-7558(p.316-24)
Argonne National Lab., Lemont, Ill.
FUSED SALTS AS THERMONUCLEAR REACTOR BREEDER BLANKETS. D. M. Gruen. p.316-24 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 9p.

The discussion envisages fused $LiNO_3$ as a breeding blanket for a thermonuclear reactor. This salt would be pumped in closed containers pressurized with nitrogen oxide gases. The radiation field is expected to aid in maintaining chemical equilibrium. Under the conditions, $LiNO_3$ would be the thermodynamically stable condensed phase. Carbonate and tritium ions would accumulate to some extent in the melt. Tritium would end up in the gas phase as T_2O and could be removed as such from the gas phase. Tritium holdup in the melt would depend on a multitude of factors which cannot as yet be evaluated for lack of experimental data. It has been assumed throughout that the chemical equilibria tending to reverse the effects of radiation decomposition would be fast compared with the radiation decomposition rate. The validity of this assumption can only be proved or disproved by experiment. The rate determining step will probably be diffusion controlled, i.e., the rate of diffusion of nitrogen oxides into the melt. (auth)

5401 TID-7558(p.325-30)
Oak Ridge National Lab., Tenn.
METAL VAPOR PUMPING. R. V. Neidigh. p.325-30 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 6p. (CF-58-2-84).

To develop techniques for metal vapor pumping, a facility which, like DCX, is a high vacuum chamber within a somewhat poorer vacuum was used. Methods for vaporizing titanium and yttrium are discussed. Pumping rates for specific gases have not yet been measured. (W.D.M.)

5402 TID-7558(p.331-3)
Oak Ridge National Lab., Tenn.
PERFORMANCE OF THE CARBON ARC AS AN ION PUMP. R. J. Mackin, Jr. p.331-3 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 3p. (CF-58-2-86).

An experiment is described which indicates that the carbon arc acts as a strong ion pump at pressures down to 2×10^{-7}. Strong pumping action of another kind was also observed, possibly the gettering action of evaporated carbon. (auth)

5403 TID-7558(p.334-41)
Oak Ridge National Lab., Tenn.
SPUTTERING OF COPPER BY IONS OF VARIOUS ENERGIES. O. C. Yonts. p.334-41 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 8p.

Sputtering studies were undertaken at ORNL because of the lack of information on sputtering rates in a magnetic field. The adaptability of the electromagnetic isotope separator to this type of study made the project particularly attractive. Most of the data presented were obtained in about three and one-half weeks of operating time on two β-calutrons made available by the Stable Isotopes Group of ORNL. (auth)

5404 TID-7558(p.342-4)
New York Univ., New York. Atomic Energy Commission Computing and Applied Mathematics Center.
JUSTIFICATION OF DEBYE CUT-OFF AND SOME QUANTUM CONSIDERATIONS. R. Liboff. p.342-4 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 3p.

The difference between the transport coefficients calculated by the usual Coulomb plus Debye cut-off procedure and those calculated using the shielded Coulomb potential over the entire scattering range is presented. To the "dominant log term" the two calculations are identical. The quantum mechanical formulation is also considered. (auth)

5405 TID-7558(p.345-50)
Oak Ridge National Lab., Tenn. and Tennessee. Univ., Knoxville.
ON THE CHEW-GOLDBERGER-LOW METHOD FOR SOLVING THE BOLTZMANN EQUATION WITHOUT COLLISION TERMS. E. G. Harris. p.345-50 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 6p.

The essence of the method is an expansion of the distribution function in powers of (M/e). That is, the Lorentz force term is assumed to be the dominant term in the equation and the remaining terms are treated as perturbations. It would seem that this approach is sensible if the radius of gyration of the particles is small compared to other dimensions in the problem, and the Larmor frequency high compared to other frequencies. This perturbation method has been applied to problems concerning a plasma in a strong magnetic field. (auth)

5406 TID-7558(p.352-6)
Oak Ridge National Lab., Tenn.
DISSOCIATION OF THE HYDROGEN MOLECULE ION

BY ELECTRON IMPACT. E. V. Ivash. p.352-6 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 5p.

The dissociation cross section of H_2 for bombardment by electrons is investigated taking into account the effect of exchange collisions by use of the Born-Oppenheimer approximation. Both the post and prior interactions are considered. Theoretical results are presented for the transition in which the molecule ion is raised from the ground state to the lowest lying repulsive state and then dissociates. The Franck-Condon principle is assumed throughout, and a classical average is taken over the molecular orientations. Numerical results are given for the dissociation cross sections as a function of energy both with and without the inclusion of exchange effects. The agreement between the post and prior interactions near the threshold energy turns out to be quite poor. (auth)

5407 TID-7558(p.357-9)
Princeton Univ., N. J. Project Matterhorn.
SOME THEORETICAL RESULTS ON PLASMA OSCILLATIONS. George Backus and John Greene. p.357-9 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 3p.

Calculations relating to the possible occurrence of electrostatic instabilities are dealt with. It is shown that several different methods of attacking of the problem lead to identical methods for determining which velocity distributions in a quiescent plasma are unstable. A formulation of this dispersion relation is given that yields considerable qualitative information. Several qualitative models of situations that could lead to instabilities are given. (auth)

5408 TID-7558(p.360-5)
Princeton Univ., N. J. Project Matterhorn.
HYDROMAGNETIC INSTABILITIES CAUSED BY RUNAWAY ELECTRONS. J. Dawson and I. B. Bernstein. p.360-5 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 6p. (AECD-3745; PM-336).

Also issued separately as AECD-3745 and previously abstracted in NSA, Vol. 13, abstract No. 1210.

5409 TID-7558(p.366-7)
Princeton Univ., N. J. Project Matterhorn.
AN ENERGY PRINCIPLE OF HYDROMAGNETIC TYPE FROM THE BOLTZMANN EQUATION. M. Kruskal and C. Oberman. p.366-7 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 2p.

Criteria useful in the discussion of plasma stability in static equilibrium are derived from the Boltzmann equation. (W.D.M.)

5410 TID-7558(p.368-9)
New York Univ., New York. Atomic Energy Commission Computing and Applied Mathematics Center.
QUALITATIVE CONSIDERATIONS CONCERNING STABILITY. Harold Grad. p.368-9 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 2p.

A brief account is given of several concepts which serve to modify some of the conclusions obtained more conventionally. (auth)

5411 TID-7558(p.371-5)
California. Univ., Livermore. Radiation Lab.
INTERCHANGE INSTABILITY BY THE BOLTZMANN EQUATION. A. N. Kaufman. p.371-5 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 5p. (UCRL-5102).

The stability of a plasma, confined by an axially symmetric poloidal field, is studied for the case of low β and arbitrary field curvature by the use of the Boltzmann equation. A formal solution for the distribution function is obtainable as a power series in the oscillation frequency. By the use of perturbation theory a stability criterion is found, similar in form to that given by hydromagnetic theory but different in detail. (auth)

5412 TID-7558(p.376-81)
Chicago. Univ.; California. Univ., Livermore. Radiation Lab.; and California. Univ., Berkeley. Radiation Lab.
THE STABILITY OF THE PINCH. S. Chandrasekhar, A. N. Kaufman, and K. M. Watson. p.376-81 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 6p. (UCRL-5103).

The Boltzmann equation is used to determine the stability criteria of a cylindrical pinch with sharp boundary, for anisotropic velocity distributions. Stable regions of the parameters are shown for several values of $P_\perp/P_\parallel$. (auth)

5413 TID-7558(p.382-8)
California. Univ., Livermore. Radiation Lab.
END-LOSSES FROM PYROTRONS. John E. Roberts. p.382-8 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 7p. (UCRL-5132).

The results of numerical calculations of the distribution functions of plasmas in pyrotrons are given. The preliminary results of some fusion reaction rates are also presented. (auth)

5414 TID-7558(p.389-401)
Princeton Univ., N. J. Project Matterhorn.
ION CYCLOTRON RESONANCE HEATING: THEORY. T. H. Stix. p.389-401 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 13p. (PM-344).

Calculations indicate that ion cyclotron heating can heat the ions in a plasma directly, swiftly, and efficiently. Radio-frequency energy is coupled into the plasma by inducing ion cyclotron waves, and the wave energy can in turn be converted into effective random ion motion energy. Such randomizing can be made to occur via cyclotron damping, where ions moving along lines of force and passing through an ion cyclotron wave "feel," because of the Doppler shift, the exact ion cyclotron frequency, and gain energy steadily. The

over-all efficiency of transfer from the r-f power source to the ions is calculated to exceed 95%, the principal loss being the ohmic loss in the copper coil carrying the r-f current. (auth)

5415 TID-7558(p.402-3)
Princeton Univ., N. J. Project Matterhorn.
ION CYCLOTRON RESONANCE HEATING. A. Lenard and R. Kulsrud. p.402-3 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 2p.

The arrangement proposed by T. Stix for ion cyclotron resonance heating is analyzed from an individual particle point of view. Penetration of the electric field into the plasma is discussed. The rate of energy transfer to ions is given. (auth)

5416 TID-7558(p.404-12)
California. Univ., Livermore. Radiation Lab.
ORBITAL STABILITY OF THE ELECTRON LAYER IN THE ASTRON. John Killeen. p.404-12 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 9p. (UCRL-5101).

The existence of equilibrium orbits for the electron layer in the Astron is shown. If a particle starting sufficiently close to the equilibrium orbit remains close to it, the equilibrium orbit is said to be stable. The stable and unstable equilibrium orbits are found for several possible applied magnetic fields. (auth)

5417 TID-7558(p.413-27)
California. Univ., Berkeley. Radiation Lab.
FELIX ACCEPTANCE STUDIES. Alper A. Garren, John R. Hiskes, Ted G. Northrop, and Lloyd Smith. p.413-27 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 15p. (UCRL-8140).

A theoretical estimate is presented of the acceptance time in Felix, taking into account the nonadiabatic and precessional effects indicated by orbit computations. Knowledge of these effects is by no means complete; for example, it will be seen that the results depend on the assumption that the magnetic moment is constant with respect to time variation in the magnetic field. The predictions of this report have been subjected to spot checks consisting of computations of specific orbits in the time-varying Felix field. These checks lead one to believe that the development should provide an adequate picture of the factors influencing end injection in a mirror machine. (auth)

5418 TID-7558(p.428-32)
New York Univ., New York. Atomic Energy Commission Computing and Applied Mathematics Center.
FORCE-FREE ELECTROMAGNET IN A SPHERICAL CAVITY. G. K. Morikawa. p.428-32 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 5p.

An approximate solution is presented for a toroidal force-free electromagnet inside a perfectly-conducting, spherical shell (force-bearing) in the limiting case of small vacuum field. (auth)

5419 TID-7558(p.433-42)
Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
MICROWAVE DIAGNOSTICS OF LOW PRESSURE PLASMAS. Sanforn C. Brown. p.433-42 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 10p.

The application of a static magnetic field to a plasma complicates the theory in that the dielectric coefficient of the plasma becomes a tensor function of the magnetic field. This implies that the refractive index of the plasma depends not only on the electron density and on the magnitude of the magnetic field, but also on the geometrical configuration of the microwave mode and its direction of propagation with respect to the direction of the static magnetic field. As an example, the effective dielectric coefficients of the simplest problem encountered in the interaction of microwaves with a magnetized plasma are quoted, namely, the propagation of a plane wave in an infinite uniform plasma. (auth)

5420 TID-7558(p.444-50)
California. Univ., Berkeley. Radiation Lab.
THE ASTRON PULSED ELECTRON GUN. N. C. Christofilos, K. W. Ehlers, and F. Voelker. p.444-50 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 7p. (UCRL-8151).

The design and construction of a pulsed electron gun, to be used in conjunction with the Astron program, is under way. The unit will consist of a million-volt pulse transformer and an electron source capable of supplying more than 100 amperes. An unusual design, with the transformer cores and windings in vacuum, is being employed. Design considerations necessary to meet the output requirements are discussed. (auth)

5421 TID-7558(p.451-9)
California. Univ., Livermore. Radiation Lab.
CYCLOTRON RESONANCE HEATING OF PLASMAS. Edmund S. Chambers. p.451-9 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 9p. (UCRL-5084).

The transfer of energy from an r-f field to a hydrogen or deuterium plasma has been studied experimentally. In all experiments a steady magnetic field in the form of a "mirror" was employed. Two different cases have been studied: in one, the azimuthal electric field, which accelerated the ions, was induced by an r-f coil placed coaxially between the mirror magnets; in the other, a radial electric field was developed between an electrode and an axial discharge. In the first case, one of the effects observed was the increase in the amount of light emitted at the ion cyclotron resonance point. In the second case, the energy absorbed from the source was measured electrically. The amount absorbed was a maximum at the ion cyclotron resonance point. (auth)

5422 TID-7558(p.460-2)
California. Univ., Livermore. Radiation Lab.
NEUTRAL BEAMS. R. E. Hester, W. A. S. Lamb, and E. J. Lauer. p.460-2 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFER-

ENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 3p. (UCRL-5088).

One of the methods that has been suggested for creating high-energy plasmas inside the magnetic containment fields of thermonuclear machines makes use of a 100-kev beam of neutral deuterium atoms. In a preliminary test 100 ma of 100-kev protons were received on a 4.75-inch diameter collector 21 feet from the ion source. Fifteen per cent of the atoms emerging from a one microgram/cm^2 mercury-vapor target were neutralized due to charge exchange. (auth)

5423 TID-7558(p.463-71)
California. Univ., Livermore. Radiation Lab.
P^4 PLASMA SOURCE. C. M. Aplin, A. L. Gardner, L. S. Hall, and H. H. Vandermark. p.463-71 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 9p. (UCRL-5113).

The general features of the P^4 plasma source experiment are outlined and the major experimental results obtained during the past year are detailed. The system has been run under conditions in which a delivered plasma of greater than 75 percent ionization and of density in the neighborhood of 10^{13} particles/cm^3 was achieved in steady-state with an observed ion energy of about 4 ev. (auth)

5424 TID-7558(p.472-8)
Princeton Univ., N. J. Project Matterhorn.
A MULTI-CHANNEL INTERFEROMETER. C. R. Burnett. p.472-8 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 7p. (PM-338).

An interference spectrometer used for spectral line profile studies is described. This instrument with single channel detection has a considerable luminosity gain over conventional grating or prism spectrometers. An 8-channel detection system is described which shows promise for single pulse line scans. (auth)

5425 TID-7558(p.479-85)
Princeton Univ., N. J. Project Matterhorn.
IMPROVED FEEDBACK INTEGRATORS. Jay Upham and Frank Bennett. p.479-85 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 7p.

The usual "Miller" integrator, used for obtaining the time integral of a signal, has definite limitations at high frequencies. Several methods for improving the high-frequency response of Miller integrators are given. The useful response of such integrators may extend over 9 decades of frequency. (auth)

5426 TID-7558(p.486-506)
Ramo-Wooldridge Corp. Physical Research Lab., Los Angeles.
THE SUPERFAST LONGITUDINAL PINCH: I. THEORY. Burton D. Fried. p.486-506 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 21p.

The superfast nonadiabatic pinch is a promising method of heating a plasma without violating the conditions necessary for subsequent confinement with a stabilized pinch. An experimental test of the feasibility of a superfast longitudinal pinch at high density is currently in progress. The ideas underlying this concept are reviewed and a simple theoretical model is used for calculations of the results to be expected from these experiments. (auth)

5427 TID-7558(p.507-15)
Ramo-Wooldridge Corp. Physical Research Lab., Los Angeles.
SUPER FAST PINCH ASSEMBLY. Vernal Josephson. p.507-15 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 9p.

An experimental assembly has been set up to explore the possibility of nonadiabatically heating a deuterium plasma to kev temperatures by a super fast pinch. The assembly produces electric field gradients in the plasma greater than 100 kv/cm. Electrical and optical diagnostics incorporated in the assembly have frequency response characteristics greater than 70 mc/sec. Moderate constriction during several successive cycles has been observed at lower than optimum gradients and higher than optimum densities. This is essentially the r-f pinch. (auth)

5428 TID-7558(p.516-17)
New York Univ., New York. Atomic Energy Commission Computing and Applied Mathematics Center.
NEUTRON EMISSION IN A DISCHARGE. Harold Grad. p.516-17 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 2p.

The thermonuclear reaction rate is computed for a plasma in an electrical discharge. A computation is made of the perturbation from the Maxwellian of the ion distribution in the presence of an electric field. (W.D.M.)

5429 TID-7558(p.518-27)
Oak Ridge National Lab., Tenn.
MAGNETIC FIELD DESIGN OF MIRROR COILS. W. F. Gauster. p.518-27 [of] PAPERS PRESENTED AT THE CONTROLLED THERMONUCLEAR CONFERENCE HELD AT THE NAVAL RESEARCH LABORATORY, WASHINGTON, D. C., FEBRUARY 3-5, 1958. 10p. (CF-58-2-83).

Data for the mirror coils of "DCX" are presented. The relations between geometrical form of the mirror coils, maximum field strength, mirror ratio, required power, and necessary copper volume are discussed using diagrams of the Fabry factor and a factor which represents the relative coil copper volume. Simplified computation and graphical methods, and an a-c magnetic model measurement device for a fast determination of the magnetic field strength produced by mirror coils are described. (auth)

5430 UCRL-2552(Del.)
California. Univ., Berkeley. Radiation Lab.
SPECIAL DEVELOPMENTS PROJECT PROGRESS REPORT TO FEBRUARY 1, 1954. Lawrence Ruby. Apr. 1954. Decl. with deletions Feb. 20, 1959. 12p. Contract W-7405-eng-48. $3.30(ph OTS); $2.40(mf OTS).

Progress in developing a high-output pulsed proton source is reported. The Ti ion source has been exam-

ined to determine the factors influencing its operation. The manner of pulsing this source and measuring the beam current is described. Disadvantages of the Ti source are discussed together with the characteristics of improved versions developed. Representative output data are presented, and the future experimental program is outlined. (auth)

5431 UCRL-2775(Del.)
California. Univ., Berkeley. Radiation Lab.
SPECIAL DEVELOPMENTS PROJECT PROGRESS REPORT II: FEBRUARY 1, 1954 TO NOVEMBER 1, 1954. Lawrence Ruby. Nov. 4, 1954. Decl. with deletions Feb. 20, 1959. 13p. Contract W-7405-eng-48. $3.30(ph OTS); $2.40(mf OTS).

Work towards developing a high-output hydrogen ion source using the principle of the titanium ion source, the release of ions from hydrogenated titanium, is described. It is concluded that previous efforts had resulted in the production of large quantities of low-energy ions but had failed in the attempt to accelerate a significant fraction of these. A new approach is undertaken that involves an entirely different geometry. Successfully accelerated and focused beams are obtained. Performance data and mass-analysis distributions are given. The problems of extraction and scaling are discussed. Future subjects of investigation are outlined. (For preceding period see UCRL-2552(Del.).) (auth)

5432 UCRL-4317
California. Univ., Livermore. Radiation Lab.
SOME ASPECTS OF THE RADIAL STABILITY IN A MAGNETIC MIRROR MACHINE. Louis R. Henrich. Mar. 19, 1954. Decl. Dec. 29, 1958. 8p. Contract W-7405-eng-48. $1.80(ph OTS); $1.80(mf OTS).

The radial motion of an ion in an axially symmetric magnetic field is discussed. It is pointed out that particles of constant velocity have clearly defined upper limits to their radial motion. This is a result of the other constant of the motion, the canonical angular momentum. These limits are independent of the number of times an ion is reflected from the mirrors, providing the field is truly axially symmetric. (auth)

5433 UCRL-4339
California. Univ., Livermore. Radiation Lab.
REFLECTION OF ELECTRONS BY A MODEL MAGNETIC MIRROR MACHINE. Franklin C. Ford. May 28, 1954. Decl. Dec. 29, 1958. 12p. Contract W-7405-eng-48. $3.30(ph OTS); $2.40(mf OTS).

A visualized electron beam has been reflected by a conventional magnetic mirror. Visualization of the beam path from the electron gun to and including the region of reflection was achieved by the "thread ray" technique of Wehnelt. The total current passing through a magnetic mirror has been measured as a function of the beam energy and angular momentum for H_2 over a range of pressures from 0.5 to 5 microns. (auth)

5434 UCRL-4350(Del.)
California. Univ., Livermore. Radiation Lab.
TABLE TOP ION SOURCE. Franklin C. Ford and Samuel G. Zizzo. June 16, 1954. Decl. with deletions Oct. 21, 1958. 16p. Contract W-7405-eng-48. $3.30 (ph OTS); $2.40(mf OTS).

Ion sources were tested for possible use in a thermonuclear reactor. Results indicate emission dependability and purity with ion currents of several hundred amperes for a period of 30 to 40 microseconds. The ratio of ions to neutrals is greater than 1:5 as measured by probes and cavity techniques. The beam energy was measured for a special geometry and is less than 10 volts for the majority of the ions. (auth)

5435 UCRL-4362(Del.)
California. Univ., Livermore. Radiation Lab.
TABLE TOP I CIRCUITRY. David B. Cummings and Charles B. Wharton. July 21, 1954. Decl. with deletions Oct. 21, 1958. 47p. Contract W-7405-eng-48.

The circuitry, electrical components, and the electrical engineering problems of Table Top I, the 140 kilojoule experimental model of a magnetic mirror machine being developed at Livermore, are described. The circuitry has operated as expected after initial trials, and it is evident that the circuitry is quite practical. (W.D.M.)

5436 UCRL-4363(Del.)
California. Univ., Livermore. Radiation Lab.
AN ENHANCED MAGNETIC MIRROR MACHINE. Franklin C. Ford. July 15, 1954. Decl. with deletions Oct. 21, 1958. 33p. Contract W-7405-eng-48. $6.30 (ph OTS); $3.00(mf OTS).

A d-c magnetic mirror machine was built and tested. Radiofrequency enhancement was included in the design through the use of r-f plates in the vacuum chamber of the machine. For proton beams of the order of 1 μa, the mirror action was observed as a function of both the r-f voltage and the magnitude of the mirror field relative to the main magnetic field. Current measurements were performed with the aid of a Faraday cup with suitable bias grids. (auth)

5437 UCRL-4372(Del.)
California. Univ., Livermore. Radiation Lab.
THE DESIGN OF A PULSED MAGNETIC FIELD COIL FOR TABLE TOP I. F. C. Ford. May 4, 1955. Decl. with deletions Oct. 21, 1958. 14p. Contract W-7405-eng-48. $3.30(ph OTS); $2.40(mf OTS).

A cylindrical coil was designed for pulsed field operation suitable for use in a model thermonuclear reactor. The coil has an eight-inch inside diameter and a length of fifty-one inches. Magnetic mirrors at the ends consist of double-layer solenoids six and one-half inches long designed to slip-over the main coil. Subsequent models of this coil were fabricated which improved the electrical insulation provided by the bonding materials and the mechanical rigidity of the coil. Peak central fields of fifteen kilogauss and mirror fields of thirty kilogauss were obtained. (auth)

5438 UCRL-4388
California. Univ., Livermore. Radiation Lab.
DR. JOHNSON'S LECTURES TO THE ARC RESEARCH GROUP. John E. Roberts. Nov. 1954. Decl. Dec. 29, 1958. 84p. Contract W-7405-eng-48. $13.80(ph OTS); $4.80(mf OTS).

Plasma oscillations and the penetration of radiofrequency electromagnetic fields into plasmas are discussed. (W.L.H.)

5439 UCRL-4402(Del.)
California. Univ., Livermore. Radiation Lab.
SHOCK IONIZATION SOURCE AND PRELIMINARY EXPERIMENTS. F. H. Coensgen, R. W. Hales, and J. C. Howard. Nov. 1954. Decl. with deletions Oct. 21, 1958. 23p. Contract W-7405-eng-48. $4.80(ph OTS); $2.70(mf OTS).

The possibility of utilizing the phenomena of shock ionization as a source for mirror-type thermonuclear reactors similar to that described by R. F. Post (UCRL-4231) was investigated at pressures of 1 mm in a small-scale experiment, i.e., a one-inch vacuum sys-

tem. At the present time initial ionization and temperature produced by the shock are quite low, being only 5 percent and ½ ev, respectively. However, the magnetic field has been found to extend the time of light emission, and to compress the luminous region. The nature of this compression is not well established and may be a diffusion phenomena. (auth)

5440 UCRL-4407

California. Univ., Livermore. Radiation Lab.
ACCELERATION OF A PLASMA BY TIME-VARYING MAGNETIC FIELDS. Richard F. Post. Dec. 6, 1954. Decl. Dec. 29, 1958. 11p. Contract W-7405-eng-48. $1.80(ph OTS); $1.80(mf OTS).

An application of the magnetic mirror principle to the acceleration of a plasma is described. It is shown that an axially symmetric magnetic field which increases with time but decreases with distance along the axis can impart a net translational energy to a plasma. This effect on a plasma is contrasted with that arising from an impressed electric field, which is not effective in producing acceleration. (auth)

5441 UCRL-4423

California. Univ., Livermore. Radiation Lab.
MEASUREMENT OF THE BEHAVIOR OF A PLASMA IN A MAGNETIC FIELD BY MEANS OF PROBES. W. H. Bostick, S. G. Zizzo, and Buford Cook. Dec. 1, 1954. Decl. Dec. 29, 1958. 29p. Contract W-7405-eng-48. $4.80(ph OTS); $2.70(mf OTS).

Probes were used to measure certain properties of the cloud of positive ions and electrons ejected from a pulsed ion source having two hydrogen-loaded electrodes. Time-of-flight measurements show the presence of H^+ ions with 50-ev directed energy, an increase of this energy with increasing pulse current in the source, a higher peak yield of ions with higher peak currents in the source, and higher yields and higher ion energies when a pulsed magnetic field is applied to the source. Directed ion energies up to 110 ev have been recorded with the use of a pulsed magnetic field impressed upon the source. The neutral positive ion-electron beam from the source has been projected against an increasing magnetic field and the reflected and transmitted signals have been recorded and compared as a function of the magnetic field. Probe signals from the plasma as it encounters the magnetic field are oscillatory, suggesting that magnetohydrodynamic phenomena are present. (auth)

5442 UCRL-4427

California. Univ., Livermore. Radiation Lab.
USE OF THERMAL ELECTROMOTIVE FORCES TO PRODUCE MAGNETIC FIELD IN A CONTROLLED THERMONUCLEAR REACTOR. Theodore G. Northrop. Dec. 27, 1954. Decl. Dec. 29, 1958. 15p. Contract W-7405-eng-48. $3.30(ph OTS); $2.40(mf OTS).

The possible use of thermal emf's to produce the plasma-containing magnetic field in a thermonuclear reactor is investigated. In any such machine the magnet producing the containing field will have to be protected from the neutron flux by a substance such as lithium with a high neutron capture cross section. This metal could be cooled by circulation through the hot junctions of a thermopile. A machine in which all of the necessary field is supplied by the kinetic energy of the neutrons from the D-D reactions appears to be large because most of the power is lost to the cold junctions by thermal conduction. Only 5 to 10% of it is accounted for by magnet dissipation. Two cases have been worked out: the cylindrical machine with minimum possible magnet volume and the machine with minimum outer diameter. (auth)

5443 UCRL-4460

California. Univ., Livermore. Radiation Lab.
THE ELIMINATION OF MICROWAVE REFLECTIONS. David Beard. Feb. 1, 1955. Decl. Dec. 29, 1958. 16p. Contract W-7405-eng-48. $3.30(ph OTS); $2.40(mf OTS).

The reflections of microwaves from the walls of a plasma-containing vessel are studied. The probable cause of the reflections is discussed, and several suggestions are made for eliminating the reflections from the waveguide in the vessel and particularly from the pyrex vessel wall and copper tubing surrounding the pyrex. Quarter-wave-thick carbon-filled plastics or glasses having a very low vapor pressure seem most promising when placed inside the pyrex cylinder. $BaTiO_3$ appears to be an excellent material when placed outside the vacuum. (auth)

5444 UCRL-4475

California. Univ., Livermore. Radiation Lab.
TRANSIENT TEMPERATURE VARIATIONS DURING THE SELF-HEATING OF A PLASMA BY THERMONUCLEAR REACTIONS. Howard D. Greyber. Mar. 21, 1955. Decl. Dec. 29, 1958. 10p. Contract W-7405-eng-48. $1.80(ph OTS); $1.80(mf OTS).

The possibility of transient temperature variations during the self-heating of a plasma by thermonuclear reactions was investigated. Calculations were performed on an IBM Card Program Calculator. Estimates of the time scale for self-heating were obtained. It was concluded that it would be unsafe to assume that the nuclear temperature is always equal to or greater than the electron temperature in a discussion of plasma instabilities for a plasma with 10 percent or greater tritium concentration. (auth)

5445 UCRL-4477

California. Univ., Livermore. Radiation Lab.
MICROWAVE DIAGNOSTICS IN ARC RESEARCH. On Determination of Physical Quantities of Gas Discharges in Ion-Containment Machines by Measurement of Microwave Propagation Coefficient. R. F. Post, T. F. Prosser, and C. B. Wharton. Apr. 1955. Decl. Nov. 4, 1958. 43p. Contract W-7405-eng-48. $7.80(ph OTS); $3.30(mf OTS).

A method for determining semi-quantitatively the time-varying plasma density in magnetic mirror machines by microwave phase-shift and attenuation measurements is described. Propagation and reflection equations are derived for the cases when the incident frequency is (a) less than plasma frequency, (b) equal to plasma frequency, and (c) greater than plasma frequency. Equations for phase shift as a function of density (using case c) in mirror machines are derived and results plotted in a generalized curve. Experiments conducted during 1952 through April 1955 are described, and typical results obtained from some of the mirror machines are presented. Densities measurable were in the range 10^{10}/cc to 10^{14}/cc. Some correlation with probe measurements is indicated. Continuing experiments are outlined, and future plans and proposals for making plasma-density and temperature measurements are indicated. (auth)

5446 UCRL-4478

California. Univ., Livermore. Radiation Lab.
MAGNETIC ACCELERATION OF A PLASMA BY A RAIL SOURCE. Winston H. Bostick. Mar. 18, 1955. Decl.

Dec. 29, 1958. 17p. Contract W-7405-eng-48. $3.30 (ph OTS); $2.40(mf OTS).

Two parallel wires close together with an arc between them form a hairpin-type of current configuration which should magnetically propel the plasma of the arc. By time-of-flight measurements with probes it has been demonstrated that directed translational energies of 290 ev can be imparted to deuterons in a plasma produced by a high-current pulsed arc at the tips of two titanium wires loaded with deuterium. It is believed that these deuterons are actually magnetically propelled. (auth)

5447 UCRL-4484
California. Univ., Livermore. Radiation Lab.
AN IMMOBILIZED PLASMA IN A NONUNIFORM FIELD (IBM Machine Code Title "PLANOUNFI"). Lewi Tonks. Feb. 18, 1955. Decl. Dec. 29, 1958. 50p. Contract W-7405-eng-48. $7.80(ph OTS); $3.30(mf OTS).

The self-consistent equations have been found for a plasma which lies in a mainly unidirectional magnetic field, which has circular symmetry and which has a harmonic variation in the direction of the magnetic field. The equations have been solved in two cases, (1) where the harmonic variation of the field is finite and the plasma is weak and (2) where the plasma is strong but the harmonic variation of the field is weak. The configurations thus found can form an important starting point for calculations of the stability of plasmas. (auth)

5448 UCRL-4487
California. Univ., Livermore. Radiation Lab.
INITIAL MEASUREMENTS ON THE ANGULAR DISTRIBUTION OF DEUTERIUM PLASMA PRODUCED BY A PULSED SPARK SOURCE. Winston H. Bostick. Mar. 24, 1955. Decl. Dec. 29, 1958. 11p. Contract W-7405-eng-48. $1.80(ph OTS); $1.80(mf OTS).

The deuterium plasma which is ejected by a 6000-ampere pulsed current through a rail-type spark source has a yield in the forward direction which is a factor of 5 to 10 greater than that in the perpendicular direction. This effect is believed to be due to the magnetic propulsion of the plasma. (auth)

5449 UCRL-4498
California. Univ., Livermore. Radiation Lab.
REPORT ON SHOCK TUBE EXPERIMENTS. Elsa L. Huber. Mar. 24, 1955. Decl. Feb. 20, 1959. 11p. Contract W-7405-eng-48. $3.30(ph OTS); $2.40(mf OTS).

An investigation of ionization by shock waves in hydrogen was initiated. The shock waves are produced in a 1-in.-diam. glass pipe by a high-voltage spark at one end. Variables which influence attainment of the maximum degree of ionization and ion temperature are described. Spectroscopic methods of measuring ion density and temperature are outlined, and improvements in the design of the shock tube are discussed. (auth)

5450 UCRL-4554
California. Univ., Livermore. Radiation Lab.
ENERGETIC NEUTRAL INJECTION INTO THERMONUCLEAR MACHINES. Eugene J. Lauer. Aug. 10, 1955. Decl. Dec. 29, 1958. 26p. Contract W-7405-eng-48. $4.80(ph OTS); $2.70(mf OTS).

A scheme is discussed in which D^+ ions would be accelerated to about 100 kev in a conventional accelerator, then be sent through a gas target from which about half the ions would emerge neutral with very little scattering or energy loss; the neutral beam would then cross into a magnetic field, and part of the atoms would be ionized and trapped by colliding with the already trapped ions. The smallest mirror machine with a central field of 30 to 40 kilogauss, 2:1 mirror ratio, and $\beta = 0.1$ to 0.5 that would trap most of the neutral beam in the steady state would be about a meter in diameter and require hundreds of amperes of D^+ ions into the neutralizer. The smallest stellarator with a field of 30 kilogauss and $\beta = 0.1$ that would trap most of the neutral beam would be about a meter long and require about 10 amperes of D^+ ions. A preliminary mirror machine experiment that might be done using the ½-ampere, 100-kev D^+ beam from the UCRL spare MTA injector is discussed. A method of starting these machines is discussed. (auth)

5451 UCRL-4569
California. Univ., Livermore. Radiation Lab.
HIGH-ENERGY PERIPHERAL INJECTION INTO MIRROR MACHINES. William I. Linlor. Sept. 22, 1955. Decl. Dec. 29, 1958. 39p. Contract W-7405-eng-48. $6.30(ph OTS); $3.00(mf OTS).

An arrangement for a peripheral injection machine is described, and its performance is estimated. For a beam of 1-ampere, 100-kv deuterons, a value of $\beta \sim 0.1\%$ appears possible. The corresponding unit volume neutron production rate would be about 500 per cm^3 per second. The mean containment time for scattering loss out the mirrors only is of the order of 10 minutes. The total neutron yield for such a mirror machine would be about 100 times greater than the "thick target" neutron yield from the direct beam pulse. Reasons for high-energy injection using the proposed geometry are discussed. These are: (a) consideration of the ratio between scattering and reaction cross sections; (b) use of time-independent mirror fields; (c) small machine volume; and (d) stability advantages based on trajectories. Expected information from an experimental machine includes the following: (a) verification of mirror-machine principle at high energy and at reasonably high plasma density; and (b) measurement of basic losses and their associated parameters. (auth)

5452 UCRL-4643
California. Univ., [Livermore]. Radiation Lab.
PRODUCTION OF LARGE ENERGETIC NEUTRAL DEUTERON BEAMS. R. E. Hester. Jan. 24, 1956. Decl. Nov. 25, 1958. 8p. Contract [W-7405-eng-48]. $1.80(ph OTS); $1.80(mf OTS).

An experiment to produce a large neutral deuteron beam is described. The beam from the MTA ion source was passed through a target of hydrogen gas where the charge-exchange mechanism produced a beam of energetic neutral deuterium atoms. The experiment confirmed the feasibility of producing these beams, although the amount of the beam was less than anticipated. (J.R.D.)

5453 UCRL-4729
California. Univ., [Livermore]. Radiation Lab.
SOME PRELIMINARY INVESTIGATIONS IN THE USE OF A SUPERSONIC MERCURY VAPOR JET FOR PROVIDING AN ENERGETIC NEUTRAL BEAM. J. F. Steinhaus. July 18, 1956. Decl. Nov. 25, 1958. 11p. $3.30(ph OTS); $2.40(mf OTS).

Preliminary tests were conducted to determine surface densities attainable in a supersonic mercury vapor jet stream. In addition, the efficiency of a mercury jet for neutralizing a proton beam and the mercury partial pressure contribution in the bore due to side streaming

from the mercury jet were examined. A vapor jet with surface densities of 16 $\mu g/cm^2$ was attained, and side streaming measurements of the mercury partial pressures in the bore solid angle indicated that the mercury in this region is tolerable. In tests in which 40-kv beams of protons were passed through the jet stream, the charged portion was reduced substantially. (J.R.D.)

5454 UCRL-4752
California. Univ., Livermore. Radiation Lab.
PLASMA HEATING BY TRANSIT-TIME MAGNETIC PUMPING IN SINGLE-TRANSIT SYSTEMS. Laurence S. Hall, Andrew L. Gardner, and Donald A. Edwards. Sept. 1956. Decl. Dec. 16, 1958. 31p. Contract W-7405-eng-48. $4.80(ph OTS); $2.70(mf OTS).

The second-order theory of transit-time heating developed by Berger and Newcomb was adapted to the calculation of the heating given a plasma which passes successively through a series of magnetic pumping cells. It appears that judicious choices of phase differences between groups of cells can give enhanced heating for a given available amount of r-f power. Transit-time magnetic pumping in single transit systems seems to be a feasible method of increasing plasma energy by amounts of the order of a factor of 10. (auth)

5455 UCRL-4755
[California. Univ., Livermore. Radiation Lab.]
PLASMA CONTAINMENT CONFIGURATION. W. I. Linlor. Oct. 11, 1956. Decl. Nov. 4, 1958. 17p. Contract [W-7405-eng-48]. $3.30(ph OTS); $2.40(mf OTS).

A description is given for a plasma containment configuration which seems to have no escape cone. The long-time containment is achieved by directional variation of the magnetic field with respect to the laboratory frame of reference. Arguments are given to show how the containment process works. Some advantages of this method are long-time containment of a plasma (minutes or more), simplified plasma introduction, efficient plasma heating, and stability at low and high plasma energy density. (L.T.W.)

5456 UCRL-5020
California. Univ., Livermore. Radiation Lab.
CYCLOTRON RESONANCE ABSORPTION BY A HYDROGEN PLASMA. E. S. Chambers. Aug. 30, 1957. Decl. Jan. 6, 1959. 17p. Contract W-7405-eng-48. $3.30(ph OTS); $2.40(mf OTS).

The energy absorbed from an electrode, supplied with r-f voltage, by a hydrogen plasma was studied experimentally. The voltage across a high-Q LC circuit, supplied with a constant current of 3×10^6 cps, was used as a measure of the resistive loss component in the plasma This voltage dropped because of conduction along magnetic field lines. However, as the magnetic field was varied through cyclotron resonance points, an additional reduction of the voltage was interpreted as evidence for ion heating. The region where this heating took place was probably confined to a thin outer layer of the discharge. (auth)

5457 UCRL-5122-T
California. Univ., [Livermore]. Radiation Lab.
PUMP-DOWN TIMES FOR THE β^+ RAY AND FELIX EXPERIMENTS. G. Gibson and W. Newcomb. Feb. 4, 1958. 20p. Contract [W-7405-eng-48]. $3.30(ph OTS); $2.40(mf OTS).

The e-folding time for the free-molecule pump-out time of the vacuum tank used for the β^+ ray experiment (N^{13} at 20°C) was found to be of the order of 46 msec, and that used for the Felix experiment (D_2 at 20°C) of the order of 12 msec. In obtaining these results backstreaming was neglected, as were the effects of the open and closed ends. (W.D.M.)

5458 UCRL-5374
California. Univ., Livermore. Radiation Lab.
THERMONUCLEAR EXPERIMENTS AT UCRL. Charles C. Damm. Nov. 1958. 12p. Contract W-7405-eng-48. $3.30(ph OTS); $2.40(mf OTS).

The diverse program of thermonuclear research at UCRL is composed of the work of five main groups. The status of four of these is mentioned briefly. The magnetic mirror machine program is described in some detail. Some of the accomplishments of this program are discussed, and present and future work outlined. (W.D.M.)

5459 WASH-115
Atomic Energy Commission, Washington, D. C.
CLASSIFIED CONFERENCE ON THERMONUCLEAR REACTORS HELD AT DENVER ON JUNE 28, 1952. Dec. 1952. Decl. Jan. 23, 1958. 124p. $19.80(ph OTS); $6.30(mf OTS).

Papers are included on two instabilities of a magnetically confined plasma, a review of the Princeton stellarator program, the properties of controlled thermonuclear reactions including discussions of the Perhapsatron and the pinch effect, the design of a high-vacuum pump which employs a gaseous discharge, experiments on the pinch effect, the possible applications of microwave and radiofrequency fields to the problem of controlled thermonuclear reactions, and on evidence of the pinch effect in N_2. (W.D.M.)

5460 WASH-146
Division of Research, AEC.
CONFERENCE ON THERMONUCLEAR REACTIONS, RADIATION LABORATORY, UNIVERSITY OF CALIFORNIA, BERKELEY, CALIFORNIA, APRIL 7, 1953. Nov. 1953. Decl. Jan. 23, 1959. 117p. $2.50 (OTS).

Papers are included on preliminary experimental results with the model A Stellarator, the engineering aspects of the model B Stellarator, studies of the pinch effect in the Perhapsatron, aspects of a high-temperature plasma in a magnetic field, problems relating to magnetic mirrors, charge transfer phenomena in thermonuclear devices, and a proposed device for confining charged particles to a localized region by means of an alternating electric field. (W.D.M.)

5461 WASH-184
Division of Research, AEC.
CONFERENCE ON THERMONUCLEAR REACTIONS, PRINCETON UNIVERSITY, OCTOBER 26 AND 27, 1954. Jan. 1955. Decl. Jan. 23, 1959. 150p. $22.80(ph OTS); $7.20(mf OTS).

Discussions are included on plasma stability, the progress of the Sherwood Project, the progress of Toy Top experiments, liquid metal instability experiments which were made to study the instabilities which occur in the acceleration of a plasma by a magnetic field, Perhapsatron activities including appendixes on the theory of Perhapsatron operation, progress of the Matterhorn Project, ion diffusion across magnetic fields, and basic concepts of the development of a thermonuclear reactor. (W.D.M.)

5462 WASH-289
Division of Research, AEC.
CONFERENCE ON THERMONUCLEAR REACTIONS, UNIVERSITY OF CALIFORNIA RADIATION LABORA-

TORY, LIVERMORE, CALIFORNIA, FEBRUARY 7, 8, AND 9, 1955. June 1955. Decl. Jan. 23, 1959. 366p. $5.00(OTS).

Sixty papers based on thermonuclear research at Princeton, UCRL, NYU, ORNL, and LASL are included. Information on the various thermonuclear reactor projects at these sites is given, and many of the characteristics of magnetic fields and plasma are treated. (D.E.B.)

5463 WASH-299
Division of Research, AEC.
THE PROBLEMS, STATUS, AND OUTLOOK OF THE SHERWOOD PROGRAM. Oct. 1955. Decl. Jan. 23, 1959. 29p. $4.80(ph OTS); $2.70(mf OTS).

The report was prepared at the request of the McKinney Panel of the Joint Congressional Committee on Atomic Energy in connection with its study of the peaceful uses of atomic energy. Its purpose was to provide the members of the panel, who had little or no prior knowledge of the field of controlled thermonuclear reactions, with a relatively nontechnical survey of the problems, status, and outlook of the Sherwood program. (W.D.M.)

5464
GAS DISSOCIATION PROCESSES IN DIRECT CURRENT GLOW DISCHARGE. K. H. Krysmanski (Ernst-Moritz-Arndt-Universität, Greifswald, Ger.). Ann. Physik 2, 263-73(1958). (In German)

In an investigation of the dissociation phenomena in rare gas mixtures, the concentration distribution of the components after production of the stationary dissociation state was determined as a function of the kind of gas, the gas pressure, current density, and tube measurements. To investigate the gas transport leading to the dissociation, the velocity with which the addition component concentrated at an electrode migrated in cloud form through the discharge tube was also measured. The results were discussed. (tr-auth)

5465
THE CALCULATION OF THE EFFECTIVE IONIZATION VOLTAGE IN PLASMA. H. Rother (Institut fur Strahlungsquellen, Berlin). Ann. Physik 2, 326-8(1958) (In German)

The decrease of the ionization voltage following impact ionization by electrons was estimated. The resultant total quantum number as a function of the carrier density agreed with the experimental values satisfactorily and with those calculated by another method. (tr-auth)

5466
ONE POSSIBILITY OF NON-STATIONARY THERMONUCLEAR REACTOR. E. Larisch. Atomnaya Energ. 5, 646-7(1958). (In Russian)

A nonstationary thermonuclear reactor model for direct transformation of a portion of plasma nuclear energy into electric energy was investigated. The suggested model consists of a cylindrical or toroidal plasma pinch, radially oscillating under the pressure of the alternating axial magnetic field, at a plasma temperature at which the energy yield exceeds the radiation loss. Conditions producing oscillations are analyzed, and it is shown that under given conditions the energy yield is considerably larger than the radiation losses. The energy difference is transmitted to the external winding which forms the magnetic field. The operating temperature with a deuterium plasma is 10^8 °K, and the sound rate in the plasma is $\sim 10^8$ cm/sec. The inherent frequency of the ~10 cm diameter plasma is 10^7 hertz, and the variation frequency of the external field is $\sim 10^2$ hertz. (R.V.J.)

5467
HEATING OF POSITIVE IONS IN A THERMONUCLEAR PLASMA. H. M. Mott-Smith (Gibbs and Cox, Inc., New York). Nuclear Sci. and Eng. 5, 68(1959) Jan.

The question of how the positive ions of a plasma get their large observed energies in the short duration of the discharge is discussed. A mechanism involving oscillation is considered. It is concluded that the achievement of high yields and high-energy conversion efficiencies depends on getting most of the energy of the primary source into the positive ions, and not on whether or not the velocity distribution of the positive ions is isotropic. (W.D.M.)

5468
UNSTABLE PLASMA OSCILLATIONS IN A MAGNETIC FIELD. E. G. Harris (Oak Ridge National Lab., Tenn.). Phys. Rev. Letters 2, 34-6(1959) Jan. 15.

The small amplitude oscillations of a fully ionized quasi-neutral plasma in a uniform time-independent externally produced magnetic field are considered. Motions of the ions and perturbations of the magnetic field are neglected. The distribution function for the electrons is assumed to depart only slightly from the zeroth order distribution. (W.D.M.)

5469
DEVELOPMENT OF HYDROMAGNETIC SHOCKS FROM LARGE AMPLITUDE ALFVÉN WAVES. David Montgomery (Palmer Physical Lab., Princeton, N. J.). Phys. Rev. Letters 2, 36-7(1959) Jan. 15.

It is shown that plane-polarized Alfvén waves of large amplitude develop rapidly into hydromagnetic shocks. It is not clear what process ultimately limits the thickness of the shock; an eventual charge separation seems more likely than the dissipation of energy by viscosity of ordinary acoustical shocks. (W.D.M.)

5470
EXCITATION OF OSCILLATIONS IN A PLASMA LAYER. M. Sumi (Electrical Communication Lab., Tokyo). Phys. Rev. Letters 2, 37-9(1959) Jan. 15.

A linearized theory of excited plasma waves was previously developed in which electron plasma oscillations excited by an injected beam into a uniform plasma were discussed in detail. The dispersion relation was derived for this case without any ambiguity by using an approximation for $|\beta| \gg 1$. As more exact and detailed characteristics of excited waves were needed, the dispersion relation was solved for an excited wave. (W.D.M.)

5471
TORUS-LIKE CONFIGURATIONS OF A PLASMA WITHOUT TOTAL CURRENT IN ITS CROSS-SECTION IN EQUILIBRIUM WITH A MAGNETIC FIELD. F. Meyer and H. U. Schmidt (Max-Planck-Institut für Physik und Astrophysik, Munich). Z. Naturforsch. 13a, 1005-15 (1958) Dec. (In German)

Torus-like configurations of a plasma in equilibrium with an exterior magnetic field exist without azimuthal current. The lines of current can be plane curves, but their planes cannot intersect in the same axis. The plasma cross section must have maxima and minima. Azimuthal and meridional cross sections are calculated. From the equilibrium conditions the construction rule for a deformable (paper) model network is

derived. This network is a true analog to the totality of equilibrium surfaces of a plasma without an interior field. It is applied to a torus configuration. (auth)

5472
INVESTIGATIONS OF THE STABILITY OF A GRAVITATING PLASMA IN CROSSED MAGNETIC FIELDS. F. Meyer (Max-Planck-Institut für Physik und Astrophysik, Munich). Z. Naturforsch. 13a, 1016-20(1958) Dec. (In German)

The stability of a plasma in crossed magnetic fields is investigated for the following equilibrium configuration. A plasma with an interior horizontal magnetic field is supported against gravity by a horizontal vacuum magnetic field which is inclined at some angle α to the interior field. This example is an extension of the case $\alpha = 0$ investigated by Kruskal and Schwarzschild. It is found that for all disturbances with small wave lengths, including those disturbances which give the Kruskal-Schwarzschild instability, stability can be restored by using a nonzero α. Perturbations of sufficiently large wave lengths are found unstable for every α and every ratio of field strength. (auth)

5473
THE INTERACTION ENERGY OF THE CHARGE CARRIER IN A PLASMA. G. Ecker and W. Weizel (Univ. of Bonn). Z. Naturforsch. 13a, 1093-4(1958) Dec. (In German)

A further clarification on the use of the equation $U_W = U_a + U_p = -\left\{\frac{2\,e^2\bar{\alpha}}{r_0} + \frac{e^2\,(1+\sqrt{2})}{D\,(\sqrt{2})^3}\right\}\overline{N} \times x$ for the description of the plasma interaction (where e = electron charge, D = Debye length, x = ionization degree, $r_0 = (V/\overline{N}\,x)^{1/3}$, Z = number of atoms present originally, and V = total volume) is presented. (J.S.R.)

CRITICALITY STUDIES

5474 AERE-CE/R-2624
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
CRITICAL ASSEMBLIES WITH HEAVY WATER SOLUTIONS OF URANYL FLUORIDE (H.A.Z.E.L.). PART I. FUEL SYSTEM. D. T. King, G. P. Wall, and W. C. J. White. Sept. 1958. 32p. $0.98(BIS).

The construction, commissioning, and operation of the fuel system for a heavy water critical assembly are described. The major problem was to prepare and dispense the fuel in such a manner that the high purity of the heavy water was maintained throughout the program. (auth)

5475 HW-58049
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
NUCLEAR SAFETY IN PROCESSING LESS THAN 5.0% U-235 ENRICHED REACTOR FUELS. N[orman] Ketzlach. Dec. 11, 1958. 23p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

Processing of reactor fuels in which the initial enrichment is less than 5% U^{235} is considered. The critical parameters for heterogeneous systems of fuel in water or in uranium solutions as well as homogeneous solutions of fuel and water are examined. In addition, nuclear safety in the use of boron poisoning to increase safe batch sizes and in the use of safe vessel geometries is discussed. A cartridge-type dissolver system for fuel elements is described, and it is pointed out that experiments to determine the neutron reflecting properties of enriched uranium solutions surrounding vessels are justified. (J.R.D.)

GEOLOGY AND MINERALOGY

5476 A/CONF.15/P/2521
Geological Survey, Washington, D. C.
SOME NEW MINERALOGICAL, GEOCHEMICAL, AND GEOLOGIC AIDS IN URANIUM EXPLORATION. (Summary based on papers 769, 772, 773, 776, 778, 779, 780, 1762, and 1935. Lincoln R. Page. 10p. $0.50(OTS).

Prepared for the Second U. N. International Conference on the Peaceful Uses of Atomic Energy, 1958.

The use of new mineralogical, geochemical, and geologic knowledge has led to the discovery and development of several types of uranium deposits not previously known in the United States. Recent advances in mineralogy have aided in the recognition of supergene deposits of black uranium oxides. Study of the distribution of elements and the alteration of detrital minerals in sandstones of the Slick Rock district has resulted in the recognition of the asymmetric distribution of various minerals on either side of the "roll" ore bodies. One of the most useful geochemical techniques applied to understanding altered ores is the study of radioactive disequilibrium. The use of lead isotope analysis of minerals is suggested as a method of indicating leaching of uranium with downward migration to unoxidized zones. Several kinds of isotopic variations in the lead of nonradioactive minerals have potential significance in prospecting for regional enrichments or local concentration of uranium or thorium. An important new development in prospecting for uranium in sedimentary rocks is the finding of major deposits in the kind of environments normally considered favorable for the accumulation of petroleum and natural gas. There appears to be promise in the analysis of ground water as a reconnaissance tool. (J.S.R.)

5477 A/CONF.15/P/2522
Geological Survey, Denver.
ADVANCES IN RADIOACTIVITY, RADIOCHEMICAL AND ISOTOPIC METHODS OF PROSPECTING. (Summary based on papers 1908, 1909, 1920, and 1936). Frank W. Stead. 12p. $0.50(OTS).

Prepared for the Second U. N. International Conference on the Peaceful Uses of Atomic Energy, 1958.

Direct methods of detecting and measuring radioactive raw materials, rather than indirect methods, are discussed. The emphasis is placed on methods applied quantitatively rather than qualitatively. The surveying techniques discussed include airborne radioactivity surveying, gamma-ray logging, and measurement of radon from drill holes. A chart gives the uranium reserves in the United States, both the total reserves and that part of the reserves based on gamma-ray logging. (J.S.R.)

5478
HEINRICHITE AND METAHEINRICHITE, HYDRATED BARIUM URANYL ARSENATE MINERALS. Eugene B. Gross and Alice S. Corey (U. S. Atomic Energy Commission, Grand Junction, Colo.); Richard S. Mitchell (Univ. of Virginia, Charlottesville); and Kurt Walenta (Institut für Mineralogie und Kristallchemie, Stuttgart). Am. Mineralogist 43, 1134-43(1958) Nov.-Dec.

Heinrichite, $Ba(UO_2)_2(AsO_4)_2 \cdot 10-12H_2O$, and metaheinrichite, $Ba(UO_2)_2(AsO_4)_2 \cdot 8H_2O$, occur as tabular, yellow to green, fluorescent, transparent to translucent crystals belonging in the tetragonal system. Optically the minerals are uniaxial (−), sometimes anomalously biaxial with 2V up to 20°. The refractive indices of heinrichite are: $\omega = 1.605 \pm 0.002$ and $\epsilon = 1.573 \pm 0.002$. Those for metaheinrichite are: $\omega = 1.637 \pm 0.001$ (1.641 ± 0.002 for the mineral from the Black Forest, Germany) and $\epsilon = 1.609 \pm 0.002$. The calculated specific gravity of metaheinrichite is 4.09 and the measured specific gravity is 4.04. The space group of metaheinrichite is $P4_2$, $P4_2/m$, or $P4_222$; $a_0 = 7.07$ Å, $c_0 = 17.74$ Å, and $a_0:c_0 = 1:2.509$, Z = 2. The minerals have thus far been found near Lakeview, Oregon, and in the Black Forest of Germany. They are named for Professor E. William Heinrich, University of Michigan. (auth)

5479

ABOUT GENESIS OF REDDEN HOST ROCKS OF HYDROTHERMAL URANIUM DEPOSITS. E. N. Baranov. Atomnaya Energ. 5, 662-3(1958). (In Russian)

Studies of redden host rocks of uranium deposits in USSR lead to the conclusion that the nature of the phenomenon is closely related to three different phenomena: the radioactivity, oxidation of iron, and participations of hydrothermal solutions. Hence, the explanations lie in radiochemical reactions taking place in hydrothermal uranium-containing solutions.

5480

INVESTIGATIONS OF THE DISTRIBUTION OF URANIUM AND THORIUM IN THE DIORITE FORMATION OF COGNE (VALLE D'AOSTA). Massimo Fenoglio and Germano Rigault. Atti. acad. nazl. Lincei Rend. Classe sci. fis. mat. e nat. 23, 107-16(1957) Sept.-Oct. (In Italian)

A study was made of the uranium and thorium distribution with respect to the mineralogical components of the lithological type which constitute the diorite massif appearing in the Valle d'Aosta and bounded in the northeastern part by the Valle de Cogne. The results showed that the radioactivity is not distributed uniformly, but is bound to the accessory minerals ortite and titanite. The average specific activity was 0.591 for the ortite and 0.0559 for the titanite. (J.S.R.)

5481

SAFETY DEVICES OF THE G-2. C. Guionnet. Bull. inform. sci. et tech. No. 20, 28-35(1958) Aug. (In French)

The safety features of the G-2 reactor are discussed in detail. The topics reviewed are the concrete shield, the protection chamber where the pipes containing the CO_2 are collected, the loading face and the loading apparatus, shielding of the control rod holes, shielding of the unloading system, and the CO_2 circuit. (J.S.R.)

5482

PRELIMINARY GEOLOGIC MAP OF THE ELK RIDGE 2 NE QUADRANGLE, SAN JUAN COUNTY, UTAH. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF-190. Richard Q. Lewis, Sr. and Russell H. Campbell. Washington, U. S. Geological Survey, 1958. $0.50.

5483

PRELIMINARY GEOLOGIC MAP OF THE ELK RIDGE 2 NW QUADRANGLE, SAN JUAN COUNTY, UTAH. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF-191. Richard Q. Lewis, Sr. and Russell H. Campbell. Washington, U. S. Geological Survey, 1958. $0.50.

5484

PRELIMINARY GEOLOGIC MAP OF THE ELK RIDGE 2 SW QUADRANGLE, SAN JUAN COUNTY, UTAH. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF-192. Richard Q. Lewis, Sr. and Russell H. Campbell. Washington, U. S. Geological Survey, 1958. $0.50.

5485

PRELIMINARY GEOLOGIC MAP OF THE ELK RIDGE 2 SE QUADRANGLE, SAN JUAN COUNTY, UTAH. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF-193. Richard Q. Lewis, Sr. and Russell H. Campbell. Washington, U. S. Geological Survey, 1958. $0.50.

5486

PRELIMINARY GEOLOGIC MAP OF THE ELK RIDGE 3 NW QUADRANGLE, SAN JUAN COUNTY, UTAH. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF-195. Richard Q. Lewis, Sr. and Russell H. Campbell. Washington, U. S. Geological Survey, 1958. $0.50.

HEALTH AND SAFETY

5487 AECU-3966

Northwestern Univ., Evanston, Ill. Technological Inst.

MODEL STUDY OF THE FATE OF POLLUTION IN A TIDAL ESTUARY. P. J. Huiswaard and Carlos G. Bell, Jr. Jan. 29, 1957. 78p. Project title: THE FATE OF FISSION PRODUCTS IN SURFACE WATERS. Contract AT(11-1)-353. $15.30(ph OTS); $5.40(mf OTS).

Results are reported from an experiment using the Savannah Estuary Model with tritium water injected as a tracer. The model was brought to an equilibrium in which salt water concentrations, current velocities, and tidal profiles reached values close to those of the prototype. One curie of tritium water was quickly injected at one point into the model at high water on the tide of larger amplitude. Some 1300 samples were collected over 42 tidal cycles and counted in a liquid scintillation spectrometer. Empirical results of pollution distribution are briefly discussed and are presented in graphical form. It was concluded that a good model will prove a practical tool for predicting the fate of radioactive wastes entering a tidal estuary. (C.H.)

5488 AECU-3974

General Mills, Inc., Minneapolis.

UPPER ATMOSPHERE MONITORING PROGRAM. Progress Report Covering Period July 1 to October 30, 1958. Report No. 1890. Sidney C. Stern, L. Torgeson, and H. Zeller. Jan. 1, 1959. 41p. Project No. 89125. Contract AT(11-1)-401. $6.30(ph OTS); $3.00(mf OTS).

Data are presented from an investigation of parameters involved in developing optimum balloon-borne sampling equipment for the determination of particulate concentration and size distribution in the stratosphere. Aerosol penetration through International Paper Chemistry fibrous filter mats for micron and submicron particulates over a wide range of linear face velocities is discussed. Expressions have been developed to predict single fiber and total mat efficiencies of fibrous filter mats. Predicted efficiencies are compared with experimental data. In a new area of research a two-stage cascade impactor designed to determine the size distribution of airborne radioactive debris is described. A modified balloon-borne direct-flow filter assembly is described which simplifies flight operations and laboratory tests. Experimental data from special balloon flights are analyzed. (auth)

5489 ANL-5919
Argonne National Lab., Lemont, Ill.
RADIOLOGICAL PHYSICS DIVISION SEMIANNUAL REPORT [FOR] JANUARY THROUGH JUNE 1958. Sept. 1958. 143p. Contract W-31-109-eng-38. $2.75(OTS).

Progress is reported in the following studies: factors influencing the dose-effect relationship of absorbance in gamma-irradiated xylene; an examination of computed values of electron drift velocity and energy distribution function in gases; measurements of the natural neutron and gamma-ray dose rates, using a twin liquid scintillation fast neutron spectrometer; the development of a simple source of monoenergetic fast neutrons; calculations of the body burden and dose rate to bones from internally deposited radium-226 and radium-228; calcium-45 tracer studies on the effect of parathyroidectomy on haversian remodeling of bone; calcium-45 tracer studies on the diffusion of calcium in bone crystallites; the effect of oxygen on ion current measurements in argon; development of a method for determining the strontium-90 content of ashed bone by the solvent extraction of its daughter yttrium-90; the determination of actinium-228 as a method for the determination of its parent radium-228 in water samples; calculations of the stratospheric strontium-90 fall-out; measurements of the concentration of radium-226 in Illinois municipal water supplies; an investigation of the source of background counts in NaI(Tl) crystals; performance data for a 9.5 by 5-inch crystal detector; the effect of meteorological variables upon the vertical and temporal distributions of atmospheric radon; tracer studies of particle diffusion in isothermal and stably stratified water; and atmospheric diffusion studies in which a smoke stack, an aerial camera, a photogrammetric analyzer, and IBM-650 computer were used to determine the ability of the lower atmosphere, in various meteorological states, to diffuse materials released into it and to determine the physical processes involved in diffusion. (For preceding period see ANL-5829.) (C.H.)

5490 ANL-5934
Argonne National Lab., Lemont, Ill.
ENVIRONMENTAL RADIOACTIVITY AT ARGONNE NATIONAL LABORATORY. Report for Year 1957. J. Sedlet. Oct. 1958. 42p. Contract W-31-109-eng-38. $1.25(OTS).

Data are summarized on the radioactivity of samples of rain water, surface water, soils, plants, river bottom silt, and animal tissues collected and analyzed during 1957. (For preceding period see ANL-5808.) (C.H.)

5491 HW-57908
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
RESEARCH AND DEVELOPMENT ACTIVITIES IN THE FIELD OF RADIOLOGICAL SCIENCES. Quarterly Progress Report [for] July–September 1958. J. W. Healy, ed. Oct. 15, 1958. 36p. Contract W-31-109-Eng-52. $1.25(OTS).

No definite pathological damage was observed in fish fed 0.006 μc and 0.06 μc phosphorus-32 per gram body weight per day, although a reduction in growth rate occurred at the 0.06 μc level. Pathological damage was evident at the lethal feeding level of 0.6 μc. Damage to the gastrointestinal tract involved all segments with equal frequency and ranged from mild damage to the epithelium at three weeks to severe damage and breakdown of the mucosa after 15 weeks. Pathological changes were also observed in the kidneys, liver, and spleen. Progress is reported in the following studies: the effects of chronic ingestion of low levels of iodine-131 in sheep and swine; the tissue distribution of single oral doses of strontium-90 in swine; blood volume determinations in swine of various ages and weights; the retention of a single dose of strontium-90 and calcium-45 in mature rats as influenced by the total calcium level of the diet; the tissue distribution of zinc-65, tungsten-185, and phosphorus-32 in rats, with emphasis on the relatively high radiation dose from phosphorus-32 in the ovary when compared to bone; the pulmonary deposition and development of lung tumors in mice following intratracheal administration of ruthenium-106; the effectiveness of various aerosol treatments in removing $Ru^{106}O_2$ particles from the pulmonary tract; the effect of variation in the strontium–calcium ratio on uptake of strontium-90 and calcium-45 by plants; the uptake of zinc-65 by plants irrigated with undiluted reactor effluent; radiobiological monitoring of the Columbia River and environs; the measurement of the vertical profiles and of the integrated cross-wind concentrations of airborne tracer materials used in diffusion and transport studies; routine monitoring activities; detailed duplicate activation analyses of the various materials which could contribute to the radioisotope level in the reactor effluent water; a test of the ability of a column of aluminum turnings to remove radioisotopes from reactor effluent; determinations of the radiation-protective ability of various anionic groups in aqueous solutions; a survey of surface features of the basalt bedrock beneath the Hanford waste disposal area; ground waste disposal studies; and fission product volatility studies. (For preceding period see HW-56928.) (C.H.)

5492 HW-58413
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
COMBUSTION HAZARDS OF ORGANIC COOLANTS. H. L. Floyd. Dec. 19, 1958. 10p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

Two types of tests were used to evaluate the combustion hazards. The first test consisted of burning the organic compound in an open pan to simulate the hazards in storage areas or where a quantity of the organic compound had collected. Compounds subjected to this type of test were monoisopropylbiphenyl (MIPB), Santowax-R, biphenyl, m-terphenyl, o-terphenyl, and a tertiary mixture of the last three compounds. Physical properties of these compounds are listed. The second test consisted of igniting hot organic vapor escaping from a high-temperature system. This test simulated leaks in the reactor system. Both MIPB and the biphenyl-terphenyl tertiary eutectic were subjected to this type of test. Over-all results of the tests are presented. (W.L.H.)

5493 HW-58636
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
A BRIEF COURSE IN RADIATION DOSIMETRY AND ITS APPLICATION TO PERSONNEL PROTECTION. William C. Roesch. Dec. 23, 1958. 53p. Contract [W-31-109-Eng-52]. $9.30(ph OTS); $3.60(mf OTS).

Radiation dosimetry refers to the determination of the energy deposited per unit mass of irradiated material by ionizing radiation. Usually the material of interest is tissue, and the results are applied to a radiobiological experiment, a radiotherapy treatment, or

the protection of personnel from radiation hazards. The same methods are applied to such engineering problems as the production of heat by reactor radiations, the use of radiation in chemical reactions or food processing, and other similar measurements. The relation of radiation dosimetry to radiation biology is reviewed. Methods of measurement are discussed. Maximum permissible limits for external and internal radiation are reviewed. Applications in radiation protection programs are discussed. 47 references. (C.H.)

5494 KAPL-1951

Knolls Atomic Power Lab., Schenectady, N. Y.

HEALTH PHYSICS REPORT FOR JANUARY–MARCH 1958. 37p. Contract W-31-109-Eng-52. $1.25(OTS).

No exposure of personnel to external or internal irradiation occurred which exceeded weekly or quarterly limits recommended in NBS Handbook 59. A total of 5 c of fission products were released to the Mohawk River without adverse effect on the use of the river water for recreation and power and as a source of drinking water. Less than 5 mc of fission products were released to the atmosphere from KAPL exhaust stacks. The influence of off-site sources of radioactivity was noted in atmospheric air, precipitation, and soil. Environmental radiocontamination levels followed, in general, previously observed patterns. A Laboratory operating and policy guide was issued which requires that all new KAPL, KAPL subcontractor, and AEC contractor personnel receive an indoctrination in radiation protection before beginning work at the Laboratory. A modified portable air sampler for I^{131} vapors has been developed which has an average collection efficiency of 90% and a sensitivity level of 2.5×10^{-10} μc of I^{131} per cubic centimeter of air. The relationship between the Universal Dosimeter readings (beta-gamma) and film badge reading for corresponding exposures has been found to be relatively good. Fading of the latent image with respect to film density for duPont 508 x-ray film was found to be 16% per 26 days. Mohawk River fish which were placed in an aquarium in the river at the point of radioactive waste release from KAPL experienced no detectable adverse effect after a three-month exposure. Improvements were made in reactor environmental hazards analyses by the development of improved and less restrictive fallout dose-rate equations. (For preceding period see KAPL-1914.) (auth)

5495 NP-7103

Poland. Krajowy Komitet Ochrony Radiologicznej, Warsaw.

MEASUREMENTS OF RADIOACTIVE FALL-OUT AND AIRBORNE RADIOACTIVITY IN WARSAW AND CRACOW DURING THE YEAR 1957. 1958. 35p.

Data are tabulated from measurements carried out in Poland during 1957 on the radioactivity from fall-out in rain and snow, dust samples, river water, and ground water. Collection and measuring procedures are described. (C.H.)

5496 NP-7177

Australia. Dept. of Supply, Melbourne; Australia. Commonwealth Bureau of Meteorology. Melbourne; Australia. Commonwealth X-Ray and Radium Lab., Carlton, Victoria; Melbourne. Univ.; and Australian National Univ., Canberra.

RADIOACTIVE FALLOUT IN AUSTRALIA FROM OPERATION BUFFALO. W. A. S. Butement, L. J. Dwyer, D. J. Stevens, L. H. Martin, and E. W. Titterton. [1958]. 32p.

Atomic weapons tests of the Buffalo series were held in Australia in 1956. Fall-out measurements were made at a network of 86 stations throughout Australia. Data are tabulated. (C.H.)

5497 NP-7207

California. Univ., Berkeley. Inst. of Engineering Research.

ON THE SMALL-SCALE NON-HOMOGENEITY OF FALLOUT DEPOSITION. G. M. Corcos. Oct. 30, 1958. 55p. Contract CD-SR-58-40.

The effects of small-scale variations of winds on fall-out deposition were examined. The effect of atmospheric turbulence aloft is negligible provided that the turbulence yields a zero mean vertical wind. In addition, the effects of the nonhomogeneity in the wind caused at ground level by the presence of ground asperites are considered. The equations of motion for the general case of a small particle in the nonuniform flow field of a viscous incompressible fluid are derived. It is pointed out that simulation with scaled-down models is difficult; however, an approximate simulation appears possible in some cases. Existing information on the trajectory of particles around objects is reviewed with attention focused on flow around long cylinders in the absence of gravity, and the trajectory of particles through separated regions of flow is examined with the help of a simple model. Finally, the effect of local topography on the deposition of fall-out is considered. (J.R.D.)

5498 NP-7208

California. Univ., Richmond. Inst. of Engineering Research.

COMPUTING PROCEDURE FOR DETERMINING ISO-INTENSITY AND ISO-DOSE CONTOURS RESULTING FROM RADIOACTIVE FALLOUT, FOR VARIOUS LEVELS OF PROBABILITY. R. C. Grassi. Jan. 15, 1958. 70p. Project CIVIL. Contract CD-GA-56-57.

An IBM 701 program was developed to compute data for plotting isointensity and iso-dose contours resulting from the effects of radioactive fall-out for various levels of probability. The program utilizes climatological data on the statistical distribution of winds and idealized fall-out patterns as well as weapon effects data. The machine calculation is a Monte Carlo simulation which involves the generation of random numbers used to represent stochastic variations in wind and delivery error from one throw to the next. The computer program is basically an iterative procedure of repeated identical attacks, with random variation of winds and delivery errors. The number of iterations is determined by the input instructions. The calculations with the random variables produce results which are not predictive of a single event but indicate the relative frequency of a condition or state occurring, such as a particular intensity or integrated dose contour. The calculation on each Monte Carlo throw determines the effect of radioactive fall-out, for the random wind selected, on each of the monitoring points, from all burst points considered. Since the result of each throw is stored and tallied, the accumulative result of fall-out from all burst points is obtained for each monitoring point. This result expressed as a percentage of the number of throws or calculations is the probability of obtaining a given level of radiation at the monitoring point under consideration. (auth)

5499 NP-7209

California. Univ., Richmond. Inst. of Engineering Research.

ISO-INTENSITY AND ISO-DOSE CONTOUR PLOTS FOR

VARIOUS PROBABILITY LEVELS, CENTRAL CALIFORNIA AND WESTERN UNITED STATES. R. C. Grassi. Mar. 31, 1958. 69p. Project CIVIL. Contract CD-SR-58-40.

Iso-dose and iso-intensity contours were plotted for various probability levels of fall-out resulting from two hypothetical thermonuclear attacks on California. Data on which the plots are based are provided by an IBM-701 computer program in which a Monte Carlo simulation is used. Three series of plots were prepared for both summer and winter meteorological conditions. One series consists of fall-out for the San Francisco Bay Area resulting from an attack in which a 20 megaton bomb was placed in each of five West Coast cities, and the other shows fall-out on Central California involving a 5 megaton attack on the principal population centers and other selected sites. Fall-out data are also plotted for eleven western states resulting from the hypothetical burst of 49 5-megaton explosives. The plots developed have certain limitations because of the mathematical model and climatological data which only approximate the conditions which would prevail in an actual attack. (C.H.)

5500 NP-7241

Stanford Research Inst., Menlo Park, Calif.

SYSTEMS ANALYSIS OF RADIOLOGICAL DEFENSE. Kendall D. Moll. Nov. 1958. 124p. SRI Project No. IU-2324.

A comparison was made of various civil defense systems and programs for radiological protection during the early post-attack period. Topics considered in detail include the effectiveness and feasibility of various types of conventional buildings when used as shelters, the effectiveness, feasibility, and cost of decontamination, evacuation both before and after fall-out arrival, fall-out hazards, warning and communications systems, administration and supporting services, and program costs and effectiveness. (C.H.)

5501 NP-7242

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

FEASIBILITY OF TUNNEL CLOSURES. Final Report. Ralph L. Barnett and R. W. Sauer. Aug. 1958. Appendix A: PHENOMENOLOGY. M. A. Chaszeyka, F. B. Porzel, and T. H. Schiffman. Appendix B: BLAST DOOR LOADING. E. V. Gallagher and G. J. Tzantzos. Appendix C: DESIGN OF BLAST-RESISTANT TUNNEL DOORS. E. L. Cohen and R[alph] L. Barnett. Appendix D: MECHANICS OF DOOR CLOSURE. M. J. Shoelson. APPENDIX E: DESIGN OF CONCRETE TUNNEL WALLS AND PARTITIONS. T. S. Dickerman and R[alph] L. Barnett. 163p.

The general objective of this program is to determine the feasibility of designing tunnel closures to resist the pressures resulting from nuclear detonations in close propinquity to horizontal continuous tunnels. A 30-ft diameter circular tunnel, which has a longitudinal centerline lying 40-ft below the ground surface, is studied. Upper bounds on the pressure inside of the tunnel are determined for a 1-MT and a 20-MT nuclear device detonated on the surface directly over the tunnel. The pressures resulting from the detonation of these weapons inside the tunnel were found to occur at approximately the same distances from ground zero as the corresponding pressures from the surface bursts. Effective closures were designed for the internal and surface bursts at distances from ground zero; corresponding to the location of the 30-psi and 100-psi outside overpressure levels which result from a surface burst. The structural forms found to be feasible for the closure applications included one-way and two-way steel slabs and hemispherical membranes. (auth)

5502 NP-7243

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

EVALUATION OF DEEP TUNNEL SHELTERS. Final Report. K. E. McKee and R. W. Sauer. Nov. 1958. 97p. ARF Project No. K149. Contract CD-SR-58-55.

The results are given of an evaluation to determine the vulnerability to nuclear detonations of deep tunnel shelter systems below major cities. The final presentation gives the combination of weapon yield and depth of tunnels associated with various levels of damage. The vulnerability is considered for both the proposed shelter system and for individual tunnels. Primarily, attention is given to the shelters proper, although some consideration is given to the entranceways and utilities. (auth)

5503 NP-tr-208

PRELIMINARY DATA ON THE EFFECTS OF ATOMIC BOMB EXPLOSIONS ON THE CONCENTRATION OF ARTIFICIAL RADIOACTIVITY IN THE LOWER ATMOSPHERE AND IN THE SOIL. B. M. Isaev and D. L. Simonenko, eds. Translated from a publication of the Academy of Sciences, U.S.S.R., Moscow, 1956. 19p.

A technique is described for detecting the presence of artificial radioactivity in the lower atmosphere and for determining the concentration of strontium-90 in the soil. Data are tabulated from measurements of environmental radioactivity in the USSR based on daily samples collected at 150 stations during 1954 and 1955. (C.H.)

5504

SAFETY OF NUCLEAR SHIPS IN PORT. P. T. Fletcher (United Kingdom Atomic Energy Authority). Atom No. 19, 10-16(1958) May.

Problems in the design and operation of nuclear-powered ships for safety while in port are presented. Discussions are included on: future nuclear merchant ships, type of reactors and their application to marine service, retaining fission products in case of failures, and transporting radioactive materials. (J.H.M.)

5505

A STORAGE AND HANDLING SYSTEM FOR RADIUM AND OTHER RADIOACTIVE SOURCES. D. W. Smithers and N. G. Trott (Royal Marsden Hospital and Royal Cancer Hospital, London). Brit. J. Radiol. 32, 99-105 (1959) Feb.

An account is presented of a radium storage and handling system. An important feature is the provision, in a room adjoining the operating theaters, of well-protected and ventilated radium safes set into the wall behind the working bench, so that the entire stock is always on hand. The dose rate in the middle of this bench when the safe contains 2.5 g of Ra is 6 mr/hour. The system includes the transfer of radium to the theater and the protection of the staff during transport and sterilization of the sources. (auth)

5506

THE PROTECTION OF THE CIVIL POPULATION. Marcello Quintiliani (Istituto Superiore di Sanita, Rome). pp. 195-218 in "Atti del Congresso Scientifico. Volume I. Sezione Nucleare, Giugno 1957." (In Italian)

The dangers of radiation to the civilian population

are discussed. The relative biological effectiveness of various radiations are indicated, and the factors which determine the degree of danger are outlined. A discussion is made on the artificial sources of radioactivity with emphasis on fall-out. The principal fission products are listed, and the toxicity of Sr^{90} is discussed. The possible symptoms of chronic irradiation are described. The maximum permissible doses are given for various radiations and parts of the body. (J.S.R.)

5507

DISPOSAL OF RADIOACTIVE WASTE. K. Saddington and W. L. Templeton. London, George Newnes Limited, 1958. 108p.

Problems associated with the containment and disposal of fission products from power reactors are discussed. The importance of adequate waste disposal facilities on the development of the nuclear power industry is stressed. Topics discussed in detail include the formation and nature of radioactive waste, the biological effects of radiation, the discharge of wastes to the natural environment, the treatment of airborne wastes, the treatment of liquid effluents, disposal methods for solid wastes, and the utilization of individual fission products. Methods of waste disposal which have been used in the past are re-examined and discussed in relation to expected future needs. (C.H.)

INSTRUMENTS

5508 A/CONF.15/P/683

Argonne National Lab., Lemont, Ill.

GASEOUS SCINTILLATION DETECTORS. Charles M. Huddleston. 6p. $0.50(OTS).

Prepared for the Second U. N. International Conference on the Peaceful Uses of Atomic Energy, 1958.

The advantages and disadvantages of the gaseous scintillation detector are described. Methods used to improve the operation are discussed. (J.S.R.)

5509 A/CONF.15/P/686

Argonne National Lab., Lemont, Ill.

A CRITICAL ANALYSIS OF THE DESIGN AND APPLICATION OF NEUTRON CHOPPERS. L. M. Bollinger, R. E. Coté, and G. E. Thomas. 24p. $0.50(OTS).

Prepared for the Second U. N. International Conference on the Peaceful Uses of Atomic Energy, 1958.

A detailed description is given of the design of the Argonne fast neutron chopper. Its characteristics are critically examined. The application of the chopper to partial and total neutron cross section measurements is illustrated with brief descriptions of several experiments. Possible improvements in the use and operation of the chopper are discussed. (J.S.R.)

5510 A/CONF.15/P/817

California Research Corp., Richmond, Calif.

FLOW MEASUREMENT BY THE TOTAL-COUNT METHOD. D. E. Hull. 7p. $0.50(OTS).

Prepared for the Second U. N. International Conference on the Peaceful Uses of Atomic Energy, 1958.

A method is described for measuring fluid flow which uses a pulsed charge of radioisotope and a radiation counter. When a discrete quantity of radioactive tracer flows past a counter fixed in or near the stream, the total number of counts from the tracer is inversely proportional to the flow rate. The counter must be calibrated in a geometry simulating that on the stream and with the isotope at a known concentration. The calibration factor is expressed in counts/second per mc/ft^3. Thereafter, to determine the flow in any such stream, all one needs to know is the quantity of isotope put in the stream and the total counts recorded while it passes. The total-count method is a completely general method for the flow of liquids or gases in any kind and size of conduit. It yields absolute values of flow rate directly from a simple theoretical formula. It applies without modification over an extremely wide range of flow rate. Examples of streams that have been gaged by this new method include the following: petroleum stocks circulating in and between units in a refining plant; cooling water in condenser manifolds; exhaust gases from an automobile; high-pressure gas from a petroleum cracking plant; a slow leak through capillary tubing; sanitary sewage and storm run-off in sewers; waste refinery water in open ditches; and natural creeks and rivers. (C.H.)

5511 BMI-1310

Battelle Memorial Inst., Columbus, Ohio.

PROTOTYPE GAGES TO MEASURE PLATE SPACING IN FLAT FUEL-PLATE SUBASSEMBLIES. Neil E. Miller, C. Vernon Weaver, and William H. Goldthwaite. Jan. 2, 1959. 15p. Contract W-7405-eng-92. $0.50 (OTS).

The feasibility of two types of gages for measuring the plate separation in flat fuel-plate subassemblies was investigated with experimental model gages. One gage is based on a four-arm strain-gage bridge mounted on a flexible beryllium-copper beam. The deflection of the sensing beam as the gage traverses the channel is continuously recorded by a strain-gage analyzer. The second gage is a liquid-filled system consisting of a small flat plunger-and-cylinder arrangement. A rubber diaphragm between the piston and the cylinder serves as the seal. As the element is inserted in the space between the plates, the piston is forced into the cylinder. The liquid, distilled water, thus displaced expands an external bellows. The variable expansion during a scan is measured by a differential transformer and recorded. The recorded output from either gage is directly proportional to the actual channel spacing and is reproducible to within 0.001 in. The general performances of the two gages are equivalent except that an error of about 0.001 in. is introduced into the calibration of the hydraulic gage for each 3°F change in ambient temperature. The strain-gage-type is temperature compensated. (auth)

5512 K-1240

Oak Ridge Gaseous Diffusion Plant, Tenn.

ACOUSTIC GAS ANALYZER DEVELOPMENT AND MANUFACTURE. B. J. Bogardus and R. C. Ritter. Feb. 4, 1959. 59p. Contract W-7405-eng-26. $1.75 (OTS).

The acoustic gas analyzer is an electro-acoustic type instrument which measures the velocity of sound in binary gas mixtures and translates this measurement into terms of mole fraction of one component of the gas. It is most sensitive and accurate for gas pairs whose constituents have large differences in molecular weight. The measurement is independent of gas pressure. The foremost problem in maintaining accurate analyses with this instrument has been the selection of suitable diaphragms for the acoustic reasonating chamber. Two approaches to alleviation of the problem, mechanical changes which facilitate diaphragm exchange and procedural developments which decrease diaphragm

selection time, are described. Electrical modifications which were found desirable are also described. In the appendixes, technical explanations of the general theory are developed to explain the diaphragm problem, and a specific procedure for their selection is given. Calculations for chamber extension further illustrate the theory. (auth)

5513 KAPL-M-DRW-1
Knolls Atomic Power Lab., Schenectady, N. Y.
S3G WIRE SCANNER. D. R. Wehner. Oct. 1, 1958. 18p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

A system is described which was developed to measure power distributions in the S3G. Measurements are made by scanning copper–titanium or pure copper wires activated in an axial direction in the core. The activations are to be made at various power levels including full reactor power. Because of the large number of wires to be counted, it is necessary to be able to obtain the irradiation data rapidly. (W.D.M.)

5514 KAPL-M-JRR-2
Knolls Atomic Power Lab., Schenectady, N. Y.
A SCINTILLATION COUNTER FOR MEASURING FISSION PRODUCT ACTIVITY. J. R. Roesser. Jan. 27, 1959. 29p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

A pair of scintillation counters has been developed for counting the γ fission product activity of irradiated fuel elements. The activity is counted as a function of position along the length of the element. The uncertainty associated with each count obtained by the system is 2% or less for reasonable counting rates. (auth)

5515 LA-2249
Los Alamos Scientific Lab., N. Mex.
THE TRICHLOROETHYLENE-SATURATED WATER AND THE TETRACHLOROETHYLENE CHEMICAL DOSIMETER SYSTEMS. Preparation and Response to Gamma Radiation. Donald G. Ott, William H. Schweitzer, Sara Beth Helmick, and Payne S. Harris. Aug. 1958. 60p. Contract W-7405-eng-36. $1.75(OTS).

Chemical dosimeter systems for measuring dose from about 5 to more than 1,000,000 rads in fast-neutron and gamma-radiation fields are presented. Experimental techniques for preparation and evaluation of these dosimeters and the effects of individual components are discussed. A simple two-band filter-photometer reader is described. (auth)

5516 LAMS-2258
Los Alamos Scientific Lab., N. Mex.
INSTRUMENTATION AND SOME RELATED PROBLEMS FOR NEUTRON FLUX MEASUREMENT OF THE LOS ALAMOS SCIENTIFIC LABORATORY KIWI-A REACTOR. D. M. Barton, H. H. Helmick, and G. A. Jarvis. Sept. 1958. 31p. Contract W-7405-ENG-36. $6.30(ph OTS); $3.00(mf OTS).

The instrumentation for neutron flux measurement from Kiwi-A at NTS is described. Startup considerations, detector design, system response adjustments, and power calibration of the reactor at some low level of power are discussed. (auth)

5517 NP-7133
Brussels. Centre d'Étude de l'Énergie Nucléaire.
KARAKTERISTIEKEN VAN TRAGE NEUTRONENDETEKTORS. (Characteristics of Slow Neutron Detectors.) A. Deruytter. June 25, 1958. 58p.

A comparative study was made of the following thermal neutron detectors: a LiI crystal with activated Eu; a proportional counter with enriched BF_3 gas; a proportional counter with ordinary BF_3 gas not enriched with B^{10}; and an existing detector of ZnS with activated Ag and B in the form of polyester. The criteria for the comparisons are discussed, and the apparatus used is described. The results are presented in detail. (J.S.R.)

5518 NP-7232
Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.
A UNIVERSAL DOUBLE-CRYSTAL NEUTRON SPECTROMETER. Report No. 46/I-B;CBK. D. O'Connor and L. Bońkowski. Dec. 1958. 12p.

The construction of a universal double-crystal neutron spectrometer of high precision is described. The instrument can be used for double- or single-crystal neutron spectrometry, as a neutron monochromator for cross section measurements in the range 0.03 to 10 ev, and as a diffractograph for powder diffraction crystallographic studies. Some illustrative results of measurements are given. (auth)

5519 RIB-31
David Sarnoff Research Center, Princeton, N. J.
DEVELOPMENT OF HIGH SPEED ELECTRON ACCELERATOR STRUCTURES. Interim Report No. 7. M. H. Greenblatt, R. M. Matheson, A. H. Sommer, and G. O. Fowler. Dec. 15, 1958. 34p. Contract AT(30-1)-1958. $6.30(ph OTS); $3.00(mf OTS).

Several six-stage structures were constructed consisting of a central electrode multiplier in which high-potential electrodes were located between successive dynodes in order to reduce the interstage transit time and transit time spread. These structures were built to measure the time spread of multipliers and to examine the focusing properties of the design. It was found that there was an optimum central electrode voltage dependent on the interdyne voltage applied, and gains of 1000 could be obtained; however, when the number of stages was increased to twelve, very little further gain could be achieved. In view of these results it was decided to redesign the structure so that the central electrode voltages would be graduated in the same manner as the dynode voltages. It is pointed out that a design to reduce the time spread caused by displacement current in the last dyanode-anode circuit and to suppress the leakage over the insulators is yet to be worked out. Another problem to be solved before final design is that of the photocathode-first dynode electron optical system. (J.R.D.)

5520 SCR-64
Sandia Corp., Albuquerque, N. Mex.
APAR–AUTOMATIC PROGRAMMING AND RECORDING. G. R. Bachand, J. L. Rogers, and T. F. Marker. Jan. 1959. 17p. Contract AT(29-1)-789. $0.75(OTS).

Presented at Eastern Joint Computer Conference, Philadelphia, December 1958.

The general characteristics are described of one of the apparatus systems to be employed in atomic weapons and components testing to automatically acquire in a digital machine language variables information transduced from force functions to common analogs of voltage and frequency. Provisions are made for programming the operation from punched tape to direct control function commands to the device under test and multiplex multichannel inputs to the digitizers. The system is of modular construction providing flexibility for application to a broad class of testing operations. Transistorized circuitry is utilized practically throughout.

Programs are stored in punched tape, and output data are punched into dual paper tapes. Provisions are made to enter identifying data separately. The output tapes are appropriately arranged to conveniently provide displays from auxiliary data processors for quality and reliability determination and entry into a digital computer for long-term data processing. (auth)

5521 SCTM-24-58(14)
Sandia Corp., Albuquerque, N. Mex.
CONSIDERATIONS IN APPLYING ETCHED CIRCUITS TO MILITARY ELECTRONIC TEST EQUIPMENT. C. A. Loftin. Mar. 12, 1958. 41p. Contract AT(29-1)-789. $7.80(ph OTS); $3.30(mf OTS).

Etched electrical circuits have been used for a number of years and are constantly being more widely applied. They are not the panacea for all design, packaging, and production problems but have generally preferred applications and inherent limitations. The development of etched circuit materials, components, and processes were geared primarily to the requirements of commercial and consumer products. This has resulted in a void in the philosophy of applying etched circuits to military electronic test equipment. It is the intent of this Technical Memorandum to fill this void by experience gained in the development of several military field test sets which employ etched circuit techniques. (auth)

5522 SCTM-455-58(15)
Sandia Corp., Albuquerque, N. Mex.
THEORY OF BIASING COMMON EMITTER JUNCTION TRANSISTORS IN SWITCHING CIRCUITS. R. H. Williams. Jan. 27, 1959. 56p. Contract AT(29-1)-789. $9.30(ph OTS); $3.60(mf OTS).

The junction transistor can be made to approximate the mechanical contact switch much more closely than almost any other electronic component. A set of definitions of ON and OFF biasing requirements for the common emitter junction transistor operated in the switching mode are given. The Ebers-Moll equivalent circuit is used to study, in detail, what the transistor currents are in the OFF condition and what the transistor voltage drops are in the ON condition. The most important transistor parameters that need to be known before circuits can be designed which bias the transistor OFF and ON in accordance with the given definitions are summarized. (auth)

5523 WAPD-E(N)-8
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
NUCLEAR INSTRUMENTS AND CIRCUIT AMPLIFIERS — LINE 7: ADEQUACY OF THE LOW LEVEL CHANNEL DETECTORS. Robert L. Ramp. Sept. 8, 1952. Decl. Feb. 25, 1957. 11p. $3.30(ph OTS); $2.40(mf OTS).

The Mark I STR neutron counters were tested under various simulated reactor conditions. They were found adequate, rugged, and should have good life. (T.R.H.)

5524 SCL-T-215
THE APPLICATION OF TEMPERATURE-MEASURING THERMISTORS IN MICROMETEOROLOGICAL RESEARCH. (Homerotermisztorok Alkalmazasa a Mikormeteorologai Kutatasban). R. Czelnai. Translated by Marcel I. Weinreich (Sandia Corp.) from Idojárás 61, 357-63(1957). 16p. $4.80(ph); $2.70(mf) JCL or LC.

Applications of thermistors in micrometeorology are discussed. Data on self-heating and temperature inertia are included for the type 2TH Tungsram thermistor. (D.E.B.)

5525
DOSIMETRY OF IONIZING RADIATIONS WITH PLASTICS. I. Kugler and A. Scharmann (Univ. of Giessen, Ger.). Atomkernenergie 4, 23-7(1959) Jan. (In German)

For measuring high radiation doses, plastics are promising great advantage. Consisting of elements with low atomic number, they meet the requirement of air equivalence. Undyed plastics are colored by ionizing radiation, i.e., the optical transmission is decreased. Colored cellophane, however, is discolored. The measuring range, using different plastics, extends from 10^5 to 10^{11} roentgens. (auth)

5526
AN X RAY COUNTER GONIOMETER WITH A FINE FOCUSING TUBE AS A RADIATION SOURCE. A. Eckardt (Friedrich-Schiller-Univ., Jena, Ger.) and F. Stary (Technischen Hochschule, Dresden). Exptl. Tech. Phys. 6, 193-202(1958). (In German)

The development of an x-ray counter goniometer is described. An attempt was made to obtain high resolving power by the use of an x-ray tube with an effective focusing range of 30 μ in the Bragg focusing installation. The effect of various factors determining the width of the interference lines was considered. Some of the first interference diagrams illustrate the resolving power obtained. (tr-auth)

5527
THE WAVE-LENGTH DEPENDENCE OF VARIOUS IONIZATION CHAMBERS. W. Seelentag (Univ. of Munich). Fortschr. Gebiete Röntgenstrahlen u Nuklearmed. 89, 753-63(1958) Dec. (In German)

Data on wavelength dependence of a number of different chamber types are compiled from the literature and from experimental results using rays of different qualities. This compilation was made so that dosimeters used with deep therapy could be used as monitors in radiodiagnostics. The data are tabulated for practical use. (auth)

5528
A DIAGRAM FOR THE DETERMINATION OF THE SATURATION LOSS IN STANDARD IONIZATION CHAMBERS. W. Hübner. Fortschr. Gebiete Röntgenstrahlen u Nuklearmed. 89, 764-7(1958) Dec. (In German)

A diagram for the determination of the correction factor K_s, used to correct for the saturation loss caused by new ion combinations, is presented. In the diagram K_s is plotted against dose rate for varied diameters of the diaphragm used for the measurements and for various field strengths in standard ionization chambers. (auth)

5529
CONTINUOUS MEASUREMENT OF WEAK BETA RADIATION IN LIQUIDS WITH A SCINTILLATOR TUBE. K. H. Kimbel and J. Willenbrink (Hauptlaboratorium der Schering AG, West Berlin). Naturwissenschaften 45, 567(1958). (In German)

A scintillator tube was designed to measure continuously weak beta radiation in liquids. The plastic scintillator NE 102 was used to make tubes with an internal diameter of 0.7 mm and an exterior diameter of 1.5 mm. The tubes were shaped into helices. The liquid containing the radioactivity was passed through

the tube. Two secondary electron multiplifiers were used in coincidence to reduce the noise. The efficiency of the scintillator tube was tested on several solutions containing C^{14} and S^{35}. (J.S.R.)

5530

STORAGE DEVICES FOR DISCREET INFORMATION STORAGE. (MEMORY DEVICES). L. P. Kraizmer. Pribory i Tekh. Ekspt. No. 6, 3-14(1958) Nov.-Dec. (In Russian)

A review is made of devices for discreet information classification and storage. The design, performance, characteristics, and comparative data are included. (tr-auth)

5531

MULTICHANNEL PAIR GAMMA SPECTROMETER. I. CALCULATIONS OF BASIC CHARACTERISTICS OF GAMMA SPECTROMETER. Yu. D. Bayukov, M. S. Kozodaev, et al. (Joint Inst. of Nuclear Research). Pribory i Tekh. Ekspt. No. 6, 23-9(1958) Nov.-Dec. (In Russian)

The resolving properties and efficiency of a spectrometer are calculated, and data are presented for the selection of optimum geometry for a multichannel system. (tr-auth)

5532

MULTICHANNEL PAIR GAMMA SPECTROMETER. II. DESCRIPTIONS OF TWELVE-CHANNEL SPECTROMETER. Yu. D. Bayukov, M. S. Kozodaev, et al. (Joint Inst. of Nuclear Research). Pribory i Tekh. Ekspt. No. 6, 30-40(1958) Nov.-Dec. (In Russian)

A twelve-channel magnetic pair-spectrometer was used in studies of γ radiation from synchrotron-generated π-meson decay. The apparatus is capable of measuring γ-energy spectra at 20 to 600 Mev. (tr-auth)

5533

ELECTRON FOCUSING IN SPIRAL SPECTROMETER. A. V. Gnedich, L. N. Kryukova, V. V. Murav'eva, and V. I. Shumshurov (Moscow State Univ.). Pribory i Tekh. Ekspt. No. 6, 41-5(1958) Nov.-Dec. (In Russian)

The electron-beam behavior in various sections of the magnetic field was investigated in order to verify the focusing data on spiral β spectrometers. The dispersion, resolving power, and light power of the apparatus were determined. The obtained data were applied in selecting optimum operating conditions for the examined spectrometer. (tr-auth)

5534

HIGH PRESSURE DIFFUSION CHAMBER IN PULSED MAGNETIC FIELD. M. S. Kozodaev, M. M. Kulyukin, et al. (Joint Inst. of Nuclear Research). Pribory i Tekh. Ekspt. No. 6, 47-55(1958) Nov.-Dec. (In Russian)

A high compression diffusion chamber, 30 cm internal diameter and 45.6 cm external diameter, was designed for operations with particle beams from a synchrocyclotron operating with light gases (H_2, D_2, and He) at 25 atm. pressure. The magnetic field is produced by a magnet-solenoid and reaches 11,200 gauss at continuous performance and 16,000 gauss at impulse. Descriptions are given of the auxiliary installations for operation and control. (tr-auth)

5535

PHOTOMETRIC MEASUREMENT OF IONIZATION IN WILSON CHAMBER. S. V. Ryabikov (Inst. of Physics, Academy of Sciences, USSR). Pribory i Tekh. Ekspt. No. 6, 56-60(1958) Nov.-Dec. (In Russian)

Descriptions are given of a photometric measurement of ionization produced by particles in a Wilson chamber. A graduated curve was plotted showing the relation between the relative darkness of tracks and the ionization. Examples of mass determinations for various particles indicate an order of error of 16 to 20%. (tr-auth)

5536

SCHEME OF SHORT RESOLVING TIME COINCIDENCE. A. A. Rudenko (Inst. of Physics, Academy of Sciences, USSR). Pribory i Tekh. Ekspt. No. 6, 60-2(1958) Nov.-Dec. (In Russian)

A simple scheme of coincidences with extremely short resolving time, used in various investigations involving calculations of elementary particles, is described. The scheme does not require amplitude rectification and can be used for the detection of particles with a wide range of energy. (tr-auth)

5537

PULSE ANALYZER. V. V. Okorokov. Pribory i Tekh. Ekspt. No. 6, 63-7(1958) Nov.-Dec. (In Russian)

Descriptions are given of a 112-channel pulse analyzer with a minimum channel width of 1 μsec and recording several pulses per cycle. (tr-auth)

5538

COMPUTER FOR RECORDING CORRELATION FUNCTIONS USED IN DECAY EVENTS. Yu. P. Betin (Inst. of Physics, Academy of Sciences, USSR). Pribory i Tekh. Ekspt. No. 6, 68-71(1958) Nov.-Dec. (In Russian)

An apparatus was designed for recording values evolved in the correlation function $\phi_{ik} = \overline{n_i \cdot n_k} - \bar{n}_i \cdot \bar{n}_k$. The measuring time was divided into ν intervals. The number of decay events of i-type n_i, k-type n_k, and the product $n_i \cdot n_k$ was recorded for each interval. The developed scheme permits direct calculation of the number of intervals ν and the summation of decays of i-type $\sum_i^{\nu} n_i$, k-type $\sum_i^{\nu} n_k$, and $\sum_i^{\nu} n_i \cdot n_k$. These values are used for calculating the values $\bar{n}_i$, $\bar{n}_k$, and $\overline{n_i \cdot n_k}$. The duration of cycles can be changed within the limits 0.08 to 20 sec. The speed of one computing channel is 5 μsec, and of the other recording the product $n_i \cdot n_k$, 120 μsec. (tr-auth)

5539

AMPLITUDE PULSE ANALYZER WITH AUTOMATIC RECORDER. A. M. Ivanchenko and G. A. Kibal'chick (All-Union Research Inst. of Chemical Reagents, Khar'kov Branch). Pribory i Tekh. Ekspt. No. 6, 71-4 (1958) Nov.-Dec. (In Russian)

A single-channel pulse analyzer with an automatic recorder and fast half-width photo peak recording is described. The γ spectrum curve is written out by an automatic galvanometer; the duration of recording with Cs^{137} is 15 min. (tr-auth)

5540

PULSE AMPLITUDE INTEGRATOR. I. D. Rapoport (Moscow State Univ.). Pribory i Tekh. Ekspt. No. 6, 75(1958) Nov.-Dec. (In Russian)

A simple recording apparatus for recording the integrated number of incoming pulses and evaluating their mean value in a lightly loaded recording channel is discussed. (tr-auth)

5541

AMPLITUDE RECORDER FOR 49 PULSES WITH A WIDE DYNAMIC RANGE. N. L. Grigorov, I. D.

Rapoport, V. S. Murgin, and F. D. Savin (Moscow State Univ.). Pribory i Tekh. Ekspt. No. 6, 109-10(1958) Nov.-Dec. (In Russian)

A multichannel pulse recorder with small-dimension cathode tubes and a wide amplitude recording range (~800) is described. (tr-auth)

5542

HIGH EFFICIENCY BORON COUNTERS. V. N. Bykov and V. A. Levdik. Pribory i Tekh. Ekspt. No. 6, 113(1958) Nov.-Dec. (In Russian)

A high-efficiency counter filled with 88% B^{10} enriched BF_3 at 700 mm mercury and using a transparent front plate is described. (R.V.J.)

5543

SUPERPRESSURE VALVE. L. F. Vereshchagin and V. E. Ivanov (Lab. of Superhigh Compression Physics, Academy of Sciences, USSR). Pribory i Tekh. Ekspt. No. 6, 114-15(1958) Nov.-Dec. (In Russian)

A design is given of a superpressure valve for pressures of 8000 atm., for a liquid or 3000 atm. gas by-pass. (R.V.J.)

5544

FAST-ACTING VALVE FOR BUBBLE CHAMBERS. B. A. Dologoshein and L. A. Kuzin (Inst. of Physics, Academy of Sciences, USSR). Pribory i Tekh. Ekspt. No. 6, 116(1958) Nov.-Dec. (In Russian)

Descriptions are given of a two-step, electromagnetic, fast-acting valve for bubble chambers. (R.V.J.)

5545

THE STANFORD MEDICAL LINEAR ACCELERATOR. II. INSTALLATION AND PHYSICAL MEASUREMENTS. M. Weissbluth, C. J. Karzmark, R. E. Steele, and A. H. Selby (Stanford Univ., San Francisco). Radiology 72, 242-53(1959) Feb.

A description is given of the physical and electrical characteristics of a traveling-wave, linear electron accelerator designed to meet the requirements of supervoltage x-ray therapy. Typical operating conditions are at an electron energy of approximately 4 Mev and a forward x-ray intensity at 1 meter from the target of 0.38 milliwatts per square centimeter. The instrumentation and technique associated with various dosimetric measurements are discussed. (auth)

5546

A BODY CAVITY DOSIMETER. Frank E. Hoecker (Univ. of Kansas, Lawrence) and Homer L. Hiebert (Stormont-Vail Hospital, Topeka, Kan.). Radiology 72, 254-9(1959) Feb.

Investigations were made on the suitability for use as a body-cavity radiation dosimeter of a styrene-polyester which is converted from a liquid to a gel upon exposure to approximately 50,000 r of x radiation. Applications in cells for direct insertion into the body cavity are described. (C.H.)

5547

PRACTICAL SPECTRAL APPARATUSES. (IDEAL AND PRACTICAL INSTRUMENTS). S. G. Rautian. Uspekhi Fiz. Nauk 66, 475-517(1958). (In Russian)

A review is given of distortions observed with a practical apparatus. These distortions are analyzed and classified into three groups. The first group includes distortions in comparatively rough structure spectra, and the second group evolves the fine structure spectra with single, double, or more spectral lines, narrow bands, etc. In addition to systematic distortions of the first and second groups, the differences between the "true" and "observed" distributions can be caused by other factors which lead to accidental mistakes in measurements. Thus, the third group deals with mistakes affecting the changes in parameters, fluctuations in the receiver, etc. 139 references. (R.V.J.)

5548

MASS SPECTROSCOPE WITH A PULSE SOURCE OF IONS. E. I. Agishev and N. I. Ionov (Leningrad Inst. of Physics and Tech.). Zhur. Tekh. Fiz 28, 1775-88(1958) Aug. (In Russian)

Data on resolving and light power of mass spectroscopes are analyzed, and optimal parameters are selected for mass analyzers. (R.V.J.)

5549

TEST OF A PORCELAIN INSULATOR FOR "STRONG" FOCUSING LENSES IN LINEAR ACCELERATORS. L. A. Dushin and V. A. Maslov (Khar'kov Inst. of Physics and Tech.). Zhur. Tekh. Fiz 28, 1837-8(1958) Aug. (In Russian)

Results showed a good agreement with tests made with porcelain rings for electrostatic generators. The numbers of ruptures and current losses depend on the time of lens training under voltage in vacuum and conditions during lens assemblage. (R.V.J.)

5550

OPTIC-ELECTRONIC APPARATUS FOR GAMMA RAY OBSERVATIONS. P. Timofeev (Academy of Sciences of USSR, Moscow). pp. 249-58 in "Atti del Congresso Scientifico. Volume I. Sezione Nucleare, Giugno 1957." (In Italian)

For the development of an optical-electronic device for the observation of gamma radiation, the problem of the form of the field in the electrostatic lenses focusing the electron current appeared. It is shown that the most suitable shape for this field was that of a hyperbola of rotation. The optical-electronic converter used for gamma radiation is shown schematically. (J.S.R.)

5551

ON THE COUNTING TECHNIQUE OF INDIVIDUAL PHOTONS OF VISIBLE LIGHT. Zs. Naray (Central Research Inst. of Physics, Budapest). pp. 575-96 in "Atti del Congresso Scientifico. Volume I. Sezione Nucleare, Giugno 1957."

The problem of the measurement of absolute light intensity is discussed. The equation describing the efficiency of the photomultiplier is derived. The apparatus used in measuring the absolute value of light intensities is described. Methods of reducing the dark current pulses of multipliers are discussed. (J.S.R.)

5552

METHODS OF GROWING SCINTILLATION CRYSTALS FOR SCINTILLATION COUNTERS. L. M. Balyaev, B. V. Vitovsky, and G. F. Dobrzhansky. pp. 197-206 in "Growth of Crystals, Reports at the First Conference on Crystal Growth, 5-10 March 1956." New York, Consultants Bureau, Inc., 1958. 294p.

The apparatus and a detailed description of the process for growing naphthalene and tolane scintillation crystals is presented. A method was developed and is presented for crystallizing stilbene. Methods and apparatus are presented for growing inorganic crystals of LiBr, LiI, KI, NaI, and CsI. (W.L.H.)

METALLURGY AND CERAMICS

5553 A/CONF.15/P/1046

[Los Alamos Scientific Lab., N. Mex.]

THE PHYSICAL METALLURGY OF PLUTONIUM AND

ITS ALLOYS. A. S. Coffinberry. 6p. $0.50(OTS).

Prepared for the Second U. N. International Conference on the Peaceful Uses of Atomic Energy, 1958.

The currently available unclassified information concerning the physical metallurgy of plutonium is summarized. Data obtained at Los Alamos are compared with data obtained elsewhere. Subjects covered include such well established physical properties of plutonium as transformation temperature, crystal structure, coefficients of thermal expansion, densities, and electrical resistivities. Also included are data concerning other properties for which measurements have been made but which are not well established, or which are defined only for a narrow temperature range. A limited amount of information concerning the mechanical properties of plutonium and some of its alloys is presented. (C.H.)

5554 AD-158412

National Research Corp., Cambridge, Mass.

OXIDATION RESISTANT COATING FOR MOLYBDENUM. Final Report. Paul L. Raymond. Jan. 8, 1958. 20p. Project No. NRC-44-1-129. Contract NOas-56-481-c.

A program was developed to study means for imparting high-temperature oxidation resistance to sintered bodies produced from molybdenum powders. Equipment was constructed and operated to coat the surface of powder grains with oxidation-resistant materials. Compacts were then formed and sintered, and a series of high-temperature oxidation tests were conducted on a wide range of materials and combinations. Unforeseen difficulties arose in coating the molybdenum particles, necessitating extensive effort on the coating problem. Except for one instance, samples produced to date have not shown appreciable oxidation resistance, and this is attributable to the inadequate coating. (auth)

5555 AD-158469

Battelle Memorial Inst., Columbus, Ohio.

HIGH-TEMPERATURE-ALLOY CUTTING PROGRAM. Report No. 3. J. E. Clifford, D. E. Semones, and J. McCallum. Mar. 31, 1958. 36p. Contract AF33(600)-35440.

A method is described for cutting titanium and other high-temperature alloys by electrolytic action alone. Experimental tests on 1 to 1½-inch-diameter stock using three rotating metal disks mounted on a common spindle have demonstrated that multiple-disk electrolytic cutting is technically feasible. Successful development of: production machine utilizing 60 rotating cathode disks (2 per cut) indicates the following time per cut for an 8-inch-diameter billet, based on experimental cutting rates: unalloyed titanium, 17 minutes; M-252 (or Waspalloy), 14 minutes; A-286, 8 minutes; low-carbon steel, 6 minutes; AISI 4340 steel (550 Bhn), 12 minutes; and AISI 4340 (180 Bhn), 12 minutes. The test on 4340 steel, which indicated that cutting rate is independent of hardness and crystal structure, met one of the project objectives of a cutoff method suitable for metal strength up to 250,000 psi. Squareness of cut (0.006-inch deviation per inch of diameter) was indicated to be satisfactory for forging operations. The main economic advantage appears to be in saving valuable metal by permitting narrow cut widths of 1/16 inch or less. Good surface finish, lack of heat-damaged or work-hardened surface, absence of burrs, etc., eliminate the need for subsequent machining operations. (auth)

5556 AD-200603

Carborundum Co. Research and Development Div., Niagara Falls, N. Y.

DEVELOPMENT OF ULTRA REFRACTORY MATERIALS. Progress Report No. 15, [for] May 1 through July 30, 1958. Peter T. B. Shaffer. Aug. 1, 1958. 8p. Contract NOrd-17175.

The design and construction of a modulus of rupture furnace, rhodium-wound alumina tube furnace, and dilatometer are presented. The preparation of $ZrO_2-SiO_2-ZrB_2$ and HfO_2-SiO_2-HfB is discussed. The preparation of HfC, HfB, and ZrB is reported. (W.L.H.)

5557 APEX-454

General Electric Co. Research Lab., Schenectady, N. Y.

FRICTION AND WEAR OF REFRACTORY COMPOUNDS. Progress Report. K. P. Zeman and L. F. Coffin, Jr. Apr. 1958. 54p. For General Electric Co. Aircraft Nuclear Propulsion Dept. Contracts AF33(600)-38062 and AT(11-1)-171. $1.50(OTS).

Refractory compounds were selected for investigation as bearings with the possibility of employing liquid metals as lubricants for these materials. An apparatus designed and built for testing ceramic materials at 2000°F in an air atmosphere or liquid metal bath is described. The borides, carbides, nitrides, and silicides of the transition metals and the common oxides which meet the requirements of high-temperature strength, hardness, and oxidation resistance were selected for study. Tests to date show that refractory compounds with solid solubility will have poor friction and wear characteristics when tested as couples. Couples of $MgO-SiO_2$, $MgO-Al_2O_3$, AlO_2-TiC, and $SiC-TiC$ show promise of sliding successfully at temperatures as high as 2000°F in air. (W.D.M.)

5558 BMI-1285(Del.)

Battelle Memorial Inst., Columbus, Ohio.

EXTRUSION CLADDING OF URANIUM FUEL PLATES. Robert J. Fiorentino, David C. Drennen, Charles J. Slunder, and A. M. Hall. Aug. 22, 1958. Decl. with deletions Dec. 18, 1958. 38p. Contract W-7405-eng-92. $6.30(ph OTS); $3.00(mf OTS).

Two methods for extrusion cladding were investigated and evaluated. In the coaxial method, the component parts of the extrusion assembly are concentric, and the fuel plate moves in the same direction as the hydraulic-press ram. In the right-angle method, the fuel-plate motion is perpendicular to that of the ram. Ribbed sheaths of aluminum were extruded satisfactorily on 3-in.-wide uranium plates in lengths up to about 10 ft. Lowest extrusion pressures were achieved with the most streamlined designs of mandrel tips, using flat-faced shear dies. Good results were obtained with billet and die temperatures of about 1050°F, at extrusion speeds up to 60 ipm. Extrusion pressures were 25,000 to 60,000 psi. End-cladding procedures were developed which involved attaching end plates machined from aluminum powder-metallurgy products (12 to 18 wt. % Al_2O_3) to the core by means of T-shaped joints, and cladding the entire assembly with aluminum. Excellent bonds were achieved, on uranium as well as on the end plugs. The median values obtained by stud weld tests were 26,000 psi for uranium, and 12,000 psi for the end plugs. The importance of proper tool alignment and avoidance of imbalance of forces caused by pressure differentials within the extrusion container was demonstrated. (auth)

5559 DMIC-Memo-4

Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.

EFFECTS OF HIGH STRAIN RATES AND RAPID

HEATING ON THE TENSILE PROPERTIES OF TITANIUM ALLOYS. F. R. Schwartzberg. Dec. 29, 1958. 33p.

Two testing techniques were developed and applied in studies of the effects of both rapid heating and high loading rates on titanium alloys. Data obtained for a series of alloys are summarized. (D.E.B.)

5560 HW-57485

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

A SPOT TEST PROCEDURE FOR IRON AND COPPER INCLUSIONS IN ALUMINUM CANS. W. E. Stavig. Nov. 17, 1958. 9p. Contract W-31-109-Eng-52. $0.50(OTS).

A spot test is presented for detecting and determining the sizes of Fe and Cu impurities in the surface of Al cans used to clad U fuel elements. The Al can surface is coated with a solution consisting of a film former, an electrolyte, an opacifier to form a cover over the metal surface, a wetting agent, and an indicator to complex the ions. This coating is sprayed on the Al surface, dried at room temperature, and electrolyzed in an electrolyte solution. The metallic impurities are changed into ions which react with the indicator to form colored compounds. The colored spots are then measured with the aid of a microscope to determine the original size of the inclusion. (W.L.H.)

5561 HW-57683

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

FUEL ELEMENT INCLUSIONS. G. R. Hanson. Oct. 13, 1958. 20p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.70(mf OTS).

The object of this work was to determine what materials caused inclusions, what size of particle caused an inclusion reject, where inclusions originated, and what methods could be used to eliminate incident and reduce background inclusions. Two types of inclusion-forming materials were found. Type one materials were metals which diffused into the Al can during canning and the entire diffused area became the inclusion. Particles as small as 0.0005 inch from type one materials caused rejects. Type two materials were particles which did not diffuse during canning and were not removed by the etching process. Thus the particle remained as the inclusion. Particles as small as 0.005 inch caused rejects. (W.L.H.)

5562 HW-57733

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

CORROSION OF BURIED PIPING 202-S BUILDING. K. K. Campbell. Oct. 17, 1958. 28p. Contract [W-31-109-Eng-52]. $4.80(ph OTS); $2.70(mf OTS).

An investigation was made to determine the cause of the leaks in the steam lines, as well as to develop a possible method of stopping or retarding future failures, and also to develop a method of repairing those lines which have failed. The pipes failed due to stress-corrosion aided by chloride ion. Tests were conducted on the practicability of repairing the damaged pipe lines by installing a plastic tube lining the full length of the pipe. (W.L.H.)

5563 MND-E-1322-T

Martin Co., Baltimore.

AUTOCLAVE TESTING OF TYPE 304 STAINLESS STEEL. Addendum to Task I, Phase 2. L. Frank and P. Eisenberg. Nov. 1958. 14p. Contract DA-44-009-ENG-3043.

This report is an addendum to MND-E-1322.

At the critical oxygen concentrations for stress corrosion cracking in the steam phase (four per cent) there is a negligible amount of oxygen in the water phase. This negligible amount at operating conditions for the experimental work approaches 2.7 ppm oxygen in the water but never reaches that value due to the conditions in the test. Therefore, actual boiler operation was duplicated in this experimentation because the oxygen in the system collects in the steam phase. Since the oxygen is a major factor in the stress corrosion cracking, it has been carefully controlled, and a maximum allowable level for the performance of stress corrosion cracking of U-bend samples in a rocking autoclave test has been reliably determined. The stresses are shown to be in the order of 34,000 to 39,000 psi at outer circumferential points measured on the U-bend. These measurements are reproducible. (auth)

5564 NLCO-764

National Lead Co. of Ohio, Cincinnati.

COMPARATIVE MEASUREMENTS OF THE VELOCITY OF PROPAGATION OF AN ULTRASONIC PULSE IN URANIUM FUEL ELEMENTS. Peter R. Morris. Nov. 24, 1958. 47p. Contract AT(30-1)-1156. $1.50 (OTS).

The principles underlying the design of equipment for the comparative measurement of the velocity of propagation of an ultrasonic pulse in uranium fuel elements are discussed. The equipment distinguishes differences in preferred orientation between alpha-rolled and alpha-rolled, beta-heat-treated uranium fuel elements and is thought to offer a more reliable test of the beta-heat-treating operation than currently employed ultrasonic grain size measuring equipment. Results obtained with this equipment are compared with (1) predicted dimensional stability during irradiation and (2) velocities of propagation calculated from x-ray-diffraction preferred orientation data and single-crystal elastic constants. While comparative ultrasonic velocity measurements or measurements of longitudinal resonant frequency can be used to reliable differentiate alpha-rolled, beta-heat-treated material from alpha-rolled material, no correlation with predicted dimensional stability during irradiation was observed. Direct theoretical relations between velocity of propagation of an ultrasonic pulse, or longitudinal resonant frequency, and predicted dimensional stability during irradiation are shown to exist only for orientations which are not likely to be obtained by known fabrication and heat treating processes. A correlation between torsional resonant frequency and dimensional stability during irradiation is predicted from theoretical considerations. No correlation was observed, however, between growth index and torsional resonant frequency. (auth)

5565 NP-7025(Pt. II)

Manufacturing Labs., Inc., Cambridge, Mass.

THE LATTICE STABILITY OF METALS. II. ZINC, COPPER, AND SILVER. Technical Report No. 2. Larry Kaufman. Jan. 1, 1959. 41p.

An integrated thermodynamic analysis of the f.c.c. (α) and b.c.c. (β) solid solutions of the Ag–Zn and Cu–Zn systems was carried out. It is found that F_E^{α} and F_E^{β} can be adequately described in both systems by a single interaction parameter. In addition, the differences in

free energy between the α, β, and η (h.c.p.) forms of zinc and the α and β forms of copper and silver were calculated as a function of temperature. The availability of these free energy differences permit estimates to be made of the cohesive energy differences between the various configurations of Zn, Cu, and Ag as well as the average Debye temperatures of the unstable forms of these metals. On the basis of these considerations it is possible to formulate the conditions for α/liquid, β/liquid, and α/β equilibrium in both systems quite accurately in terms of a few physically meaningful parameters. Furthermore, it is possible to calculate the activity of zinc in the α and β phases of Cu–Zn and Ag–Zn over a wide range of temperature and composition. In each case, good agreement between the calculated and observed activity data is obtained. (auth)

5566 NP-7125
Brussels. Centre d'Étude de l'Énergie Nucléaire.
STUDIE VAN DE HERSTELTRAPPEN DER RESISTIVITEIT IN MET NEUTRONEN BESTRAALDE HOOG-SMELTPUNT-METALEN. VORDERINGSVERSLAG OVER DE PERIODE VAN 15 JUNI TOT 15 SEPTEMBER 58. (Study of the Stepwise Production of Resistivity in High Melting Point Metals Irradiated with Neutrons. Progress Report for the Period of June 15 to September 15, 1958.) J. Nihoul. 11p.

The experimental results obtained in the study of the stepwise production of resistivity of neutron-irradiated tungsten heated from liquid nitrogen temperature are reported. Sample preparation and experimental conditions are described. (J.S.R.)

5567 NP-7131
Brussels. Centre d'Étude de l'Énergie Nucléaire.
HYDRURATION DE L'URANIUM. (Hydridation of Uranium.) G. Detiffe. Mar. 27, 1958. 8p.

The conditions for preparing a uranium hydride with the formula UH_3 from metal shavings were determined. The purity of the product is satisfactory, but in order to obtain a powder stable under compression it is necessary to work in glove boxes. This avoids the formation of a light oxide film which appears to interfere with the compression. (tr-auth)

5568 NP-7144
Brussels. Centre d'Etude de l'Energie Nucléaire.
FABRICATION D'ALLIAGES ALUMINIUM–URANIUM. (Fabrication of Aluminum–Uranium Alloys.) J. J. Huet. Apr. 4, 1958. 21p.

An investigation was made of the preparation of a homogeneous ingot of an aluminum–uranium alloy which would be easily rollable. It was found that it is easy to prepare in an air furnace the alloy containing 25% uranium by melting the aluminum under circulating nitrogen or a layer of cryolite and then adding the uranium. By running the alloy at 950°C into a horizontal copper mold, a sound ingot which is easily rolled and with a good surface is obtained. The difference in composition between the head and foot of the ingot is low. (J.S.R.)

5569 NP-7146
Brussels. Centre d'Etude de l'Energie Nucléaire.
LA METALLURGIE DE L'URANIUM. (The Metallurgy of Uranium.) D. Tytgat. Jan. 3, 1958. 6p.

A résumé of the conference given for technical instruction on the metallurgy of uranium is presented. (J.S.R.)

5570 NP-7173
Watertown Arsenal Lab., Mass.
JOINING OF SHEET TITANIUM. Bi-monthly Progress Report No. 8. G. M. Orner and C. E. Hartbower. Oct. 31, 1958. 10p.

The results of the tests on Ti–4Al–3Mo–1V and Ti–6Al–4V sheet indicate that in the presence of a notch the Ti–4Al–3Mo–1V alloy is much more likely to develop catastrophic fracture than the better heats of Ti–6Al–4V. In view of these findings, and the not-very-large strength advantage of the Ti–4Al–3Mo–1V alloy (particularly in terms of 0.02% yield), the use of Ti–4Al–3Mo–1V in preference to Ti–6Al–4V does not appear to be advisable for critical applications where notch sensitivity is deemed an important consideration. (auth)

5571 NP-7220
North Atlantic Treaty Organization, Paris. Advisory Group for Aeronautical Research and Development.
MATERIAL PROPERTIES HANDBOOK. VOLUME I. ALUMINUM ALLOYS. Aug. 1958. 157p.

This volume deals with those Al alloys which are most widely used structurally in aircraft of the NATO nations. The data are divided into national sections, each section dealing with the alloys produced by one country. The properties included on the charts are: general properties (chemical composition and physical properties), static properties, fatigue properties, short-time properties at elevated temperatures, recovered properties after exposure to elevated temperature, and properties under load and elevated temperature. (W.L.H.)

5572 NP-7229
Brown Univ., Providence.
PREDICTION OF ELASTIC CONSTANTS OF MULTI-PHASE MATERIALS. Technical Report No. 3. B. Paul. Jan. 1959. 22p. Contracts Nonr-562(19).

The energy theorems of elasticity theory are used to find upper and lower bounds on the elastic moduli in tension and shear for two-phase materials. A "strength of materials" type of approximate solution is also given. Comparison with experimental data for a particular alloy system shows good correlation for the approximate solution, with the scatter band bounded by the predicted limits. It is shown that the method may also be used for more general multi-phase systems and to predict temperature dependence of the elastic constants of the composite material. (auth)

5573 NRL-5263
Naval Research Lab., Washington, D. C.
CRACK PROPAGATION TESTS OF SOME HIGH-STRENGTH SHEET STEELS. J. E. Srawley and C. D. Beachem. Dec. 19, 1958. Project NR 510-000. 29p.

The results of crack propagation tests using ½-in.-wide center-cracked tensile specimens are presented for eight different high-strength sheet steels. In each case the net fracture stress and the fracture appearance, in terms of the percentage of the thickness of the specimen occupied by the shear borders, are exhibited as a function of testing temperature over a suitable range to include the transition from brittle to tough behavior. The conventional ultimate and yield tensile strengths are given over the same range for comparison. The fracture-appearance transition temperature is defined as the lowest temperature at which a specimen would exhibit an entirely shear fracture, and the net fracture-stress transition temperature is arbitrarily defined as the lowest temperature at which the net fracture stress would equal the yield strength. A tentative criterion for evaluation of materials is suggested: that the fracture-appearance transition temperature must not exceed the lowest temperature of

operation of the intended application if the risk of brittle failure is to be minimized. The fracture-appearance criterion has the advantage that it is a feature which can usually be readily determined for all types of test and service failures. Only two steels were found to have a combination of room-temperature yield strength in excess of 200 ksi with fracture-appearance transition temperatures at or below room temperature. One was a proprietary low-alloy steel (0.083 in. thick) and the other a "semi-austenitic" precipitation hardening steel (0.10 in. thick). Further testing of these two steels, using wider specimens and also specimens with their major axes transverse to the direction of rolling, is desirable. Some results are given in an appendix which show that there is good agreement between the net fracture-stress values obtained by using specimens cracked by hydrogen embrittlement and straining, and those cracked by fatigue stressing. (auth)

5574 NYO-2293

Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy.

THE ADAPTATION OF NEW RESEARCH TECHNIQUES TO MINERAL ENGINEERING PROBLEMS. Oct. 31, 1958. 49p. Contract AT(30-1)-956. $1.50(OTS).

The adsorption isotherms of dodecylamine on quartz at various constant alkaline pH values are given. Data are given on adsorption of H^+ on quartz as a function of pH at 10^{-1} M ionic strength and as a function of pH at different ionic strengths. Solubility tests were run on quartz at 60, 70, 80, 90, and 100°C. Pure water, 10^{-2} N NaCl, and 10^{-2} M Borax solutions were used as solvents. The uptake of Cl^- by muscovite was briefly studied. The study of uptake of dodecylammonium ion by muscovite was continued. A study of xanthate flotation of pyrite is presented. The experimental work of the Comminution Project was aimed at determining the fundamental properties which control the fracture of brittle materials. (W.L.H.)

5575 NYO-4805

Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy.

KINETICS OF REACTIONS BETWEEN LIQUID METALS AND LIQUID SALTS. Progress Report Covering Period March 1, 1958 to December 15, 1958. Thomas B. King. 24p. Contract AT(30-1)-1985. $4.80(ph OTS); $2.70(mf OTS).

The kinetics of reactions involving both transport control and phase boundary reaction control are being studied by direct rate measurements and by electrochemical polarization techniques. Measurements of diffusion coefficients are proceeding as part of the program to aid in the interpretation of the kinetic results. Transport control is confirmed for some systems, but side reactions have complicated the study of phase-boundary control. (auth)

5576 RDB(C)/TN-16

United Kingdom Atomic Energy Authority. Industrial Group. Culcheth Labs., Culcheth, Lancs, England.

A STUDY OF RELIABLE METHODS OF ASSESSMENT OF THE CORROSION RESISTANCE OF CHROMIUM–NICKEL AUSTENITIC STEELS IN NITRIC ACID. A REVIEW OF PROGRESS TO SEPTEMBER 1, 1952. H. N. Jones. 1958. Date of MS. Nov. 13, 1952. 12p.

Data on the corrosion of 18/13/1 austenitic steel in boiling 70% nitric acid were supplied by the manufacturers of the steel. The results from the various laboratories differed over a considerable range. It was found that the main factor producing these variations was the degree of contamination of the nitric acid by corrosion products of the steel. Further investigations revealed that the main influence was exercised by the presence or absence of chromate ions and that formation of these ions could be suppressed by using an internal or "cold finger" condenser. It was shown that the austenitic chromium–nickel steels are more susceptible to attack along edges perpendicular to the direction of hot rolling. Rapid penetration occurs along slag stringers included in the steel. In most cases, the penetration rate, initially quite low, slowly increased to a ceiling rate which then remained constant. The effects of pretreatment on specimens, i.e., heat treatment, pickling, and polishing, were investigated, and the weight loss method of estimating corrosion was compared with other methods. Recommended methods of carrying out corrosion tests in boiling nitric acid are described. (auth)

5577 TIB/BIB(U)-4

Gt. Brit. Ministry of Supply. Technical Information Bureau.

METAL FATIGUE. A Bibliography of Unpublished Reports. Aug. 1955. 26p. (AD-84988).

A bibliography of unpublished reports on Al and Al alloys, steel and Fe, other metals and alloys, joints, bolts, welds, aircraft and aircraft components, sandwich constructions, fatigue testing machines, and corrosion fatigue is given. 306 references. (T.R.H.)

5578 TID-3524

Technical Information Service Extension, AEC.

REFRACTORY METALS AND THEIR ALLOYS. A Literature Search. Theodore F. Davis, comp. Jan. 1959. 12p. $0.50(OTS).

This literature search includes 93 references to unclassified AEC and non-AEC reports on refractory metals and their alloys. The materials covered include those with reasonably high melting points. (auth)

5579 UCRL-4488

California. Univ., Livermore. Radiation Lab.

BONDING OF URANIUM TO URANIUM. Jack K. Y. Hum. Mar. 31, 1955. Decl. Dec. 30, 1958. 10p. Contract W-7405-eng-48. $1.80(ph OTS); $1.80(mf OTS).

The mechanical properties of powdered and cast U bonded to itself by sinter welding were investigated. Joints approaching that of the parent material are possible. There is no significant difference in the cast and powdered material. (T.R.H.)

5580 WADC-TR-57-344(Pt. II)

Westinghouse Electric Corp. Aviation Gas Turbine Div., Kansas City, Mo.

DEVELOPMENT OF NIOBIUM-BASE ALLOYS. [Period covered] June 1, 1957 to June 1, 1958. Richard T. Begley, ed. Nov. 30, 1958. 192p. Contract AF33(616)-3316.

Flow and fracture studies indicate that the ductile-to-brittle transition of niobium is little affected by oxygen content in the range 0.01 to 0.1% O_2. The impact transition range of electron-beam-melted niobium was found to be considerably below that of powder metallurgy niobium of somewhat higher oxygen concentration. Strain hardening and strain aging in niobium were studied. An activation energy of 27,100 cal/mole was determined for strain aging in niobium. The recrystallization behavior of electron-beam-melted niobium was studied in detail. Creep-rupture data were obtained on electron-beam-melted niobium at 871 and 982°C. The electron-

beam material had much lower rupture strength than powder metallurgy niobium containing 0.6% Zr tested previously. The effect of temperature on the modulus of elasticity of niobium and tantalum was determined in the range 25 to 900°C. Studies of the thermodynamics of niobium oxides and the kinetics of Nb–water vapor reaction were carried out. The thermodynamic functions obtained in this study for the formation of Nb_2O_5 from Nb_2O_4 are in excellent agreement with calculated values. A selection of the most promising weldable niobium-base alloys was made on the basis of available physical and mechanical property data. Niobium of low oxygen and nitrogen content was produced by cage-zone and floating-zone melting techniques. Evaluation of material prepared by electron-beam melting and vacuum arc melting was carried out. (auth)

5581 WADC-TR-58-162
Martin Co., Baltimore.
STRUCTURAL EVALUATION OF BERYLLIUM PRODUCED BY SEVERAL PROCESSES. Period covered: June 1, 1957 to February 28, 1958. B. B. Muvdi. Apr. 25, 1958. 76p. Project No. 1368. Contract AF33(616)-5180.

Five different beryllium fabrication processes were thoroughly examined in order to determine the process that would yield beryllium plate or sheet with optimum characteristics. The results of metallographic examinations, texture analysis, and mechanical tests indicated that cold compacting beryllium powder, followed by upsetting, yielded the optimum combination of uniaxial as well as biaxial properties. Furthermore, this process was favored because it resulted in comparatively good surface finish and was relatively simple and economical to perform. Tension and flexure tests indicated that beryllium fabricated by cold compacting and upsetting is capable of appreciable plastic deformation before fracture. Tensile elongations and reductions in area of approximately 7% were obtained. A form factor of approximately 1.6 for a rectangular cross section was also observed. Furthermore, cantilever fatigue tests on this material indicated a fatigue strength at 10^7 cycles approximately equal to 45% of the tensile ultimate. These data compare favorably with those for other structural materials. (auth)

5582 WADC-TR-58-218
Dow Chemical Co., [Midland, Mich.].
FORGING CHARACTERISTICS AND PROPERTIES OF HM21XA AND EK31XA MAGNESIUM ALLOY PRODUCTION FORGINGS. [Period covered]: May 16, 1957 to June 30, 1958. J. F. Pashak. June 15, 1958. 170p. Project title: METALLIC MATERIALS. Task title: IMPROVED MAGNESIUM ALLOYS. Contract AF33(616)-3578. (AD-204797).

This production closed-die forging program was established for the purpose of determining the forging characteristics and properties of two high-temperature magnesium alloys, HM21XA and EK31XA, in five sets of commercial design tools. Both cast and extruded material was used as forging stock. Test specimens for room and elevated temperature testing were taken from the forgings in normal production test locations after the HM21XA forgings were aged to the -T5 temper and the EK31XA forgings were heat treated to the -T6 condition. EK31XA alloy is readily forgeable in regular hydraulic presses and the Air Force heavy presses with stock temperatures of 750 to 950°F and die temperatures of 700 to 850°F. HM21XA alloy is relatively stiff to forge in this temperature range and the alloy is also susceptible to cracking when subjected to bending moments during the forging cycle. The cast forms of both alloys are slightly stiffer to forge than the extruded forms. The strength properties and creep resistance of EK31XA-T6 production forgings are outstanding at temperatures to 500°F. Properties of HM21XA-T5 forgings, although lower than anticipated at moderate temperatures, duplicate those obtained on laboratory material at the higher testing temperatures. Optimum properties are obtained in this alloy by strain hardening and maintaining the Mn content at about 0.60%. Modulus, shear, bearing, and fatigue properties for both alloys are presented at appropriate testing temperatures. (auth)

5583 WADC-TR-58-299
Battelle Memorial Inst., Columbus, Ohio.
A STUDY OF REFRACTORY MATERIALS FOR SEAL AND BEARING APPLICATIONS IN AIRCRAFT ACCESSORY UNITS AND ROCKET MOTORS. Period Covered: March 1, 1957 to February 28, 1958. L. B. Sibley, C. M. Allen, W. J. Zielenbach, C. L. Peterson, and W. H. Goldthwaite. July 1, 1958. Project title: CERAMIC AND CERMET MATERIALS. Task title: CERAMIC AND CERMET MATERIALS DEVELOPMENT. Contract AF33(616)-3995. 59p. (AD-203787).

A number of ceramic, cermet, and high-temperature alloy materials have been evaluated for corrosion resistance and for friction and wear behavior in an oxidizing atmosphere from 1000 to 1800°F. Rubbing-wear experiments were conducted at 200 feet per second sliding speed with about 20-psi load pressure usually applied to the contact surfaces. Several material combinations involving an alumina–chromium–molybdenum cermet, silicon carbide, alumina, and perhaps a titanium carbide–nickel–molybdenum cermet may be satisfactory for short-life rubbing-seal applications under these conditions. The applications of these materials are limited since they wear rapidly and exhibit erratic frictional behavior. Superficial surface cracking was observed on the wear surfaces of all specimens containing brittle ceramic phases except possibly silicon carbide. A wear-failure mechanism for refractory materials under sliding contact is postulated, and some correlation of the experimental results with conventional thermal-stress-resistance parameters is obtained. Two rubbing-wear experiments were conducted in a high-temperature reducing atmosphere. The static corrosion resistance of several potential bearing and seal materials was determined in a nitric acid oxidizer used in some rocket-propellant pumps. Experimental ceramic and cermet materials were fabricated, and some of these specimens were evaluated in rubbing-wear experiments in the oxidizing atmosphere to study certain material-property effects on friction and wear behavior. (auth)

5584 WADC-TR-58-342
Illinois Inst. of Tech., Chicago. Armour Research Foundation.
MECHANICAL PROPERTIES OF CHROMIUM. Period covered: April 1, 1956 to May 31, 1958. Arthur G. Metcalfe, Sheldon A. Spachner, and W. Rostoker. June 1958. 77p. Project No. 7021. Contract AF33(616)-2978. (AD-202559).

Vacuum melting in zirconia, cold crucible nonconsumable arc melting, and powder extrusion were used for the consolidation of chromium and chromium alloys, using

an electrolytic chromium containing 0.5% oxygen and 0.03% nitrogen. The cast ingots were forged, warm-worked, and recrystallized to a controlled grain size. Some ingots were extruded at low temperatures to achieve greater reductions of grain size. Grain size was shown to have a small influence on the ductile-brittle transition temperature for this type of chromium. Heat treatment is very effective, under some conditions, in reducing the transition temperature, particularly when it reduces the yield stress. A theoretical analysis has been made to correlate these observations with the theory of the ductile-brittle transition. High recrystallization temperatures and resistance to grain growth above 1200°C characterized some of the extruded alloys. These alloys had high strengths at temperatures of 900°C and above. It was shown that nitrogen alone is not responsible for the brittleness of chromium, whether in solution or as a precipitate. This has been confirmed by an analysis of previous work, which showed in each case that some other factors may have been responsible for the deleterious effects attributed to nitrogen. Strain rate appeared to have little effect on the ductility of chromium. Strain aging occurred to some extent in all alloys (including the titanium stabilized) and caused the maximum strengths to be found at 550°C. There appeared to be a correlation between a reduction of the yield stress and a reduction of the ductile-brittle temperature for one alloy, but it was shown that some methods of raising the yield stress do not raise the transition temperature. By analogy with the problem of ductility in steel at low temperatures it is believed that a more complete understanding of the interplay of grain size, heat treatment, and composition will be necessary before further advances can be made. (auth)

5585 AEC-tr-3495

AIR-LUBRICATED SLIDING BEARINGS. (Gleitlager mit Luftschmierung). H. Drescher. Translated for Oak Ridge National Lab. from VDI Zeitschrift 95, 1182-90D(1953). 36p.

A discussion of sliding bearings lubricated by atmospheric air is presented. In these bearings the supporting pressure is produced hydrodynamically by the motion of the shaft. Application is limited mainly by the low load-carrying capacity of the bearings. In addition, attention must be given to accurate prediction as well as to protection from dust. The largest electrical equipment using these bearings is an asynchronous alternating-current motor with an output of 16 kw and a speed of 3000 rpm. The motor delivers moment of torsion through a flexible coupling to prevent an overload on the radial bearings. (J.R.D.)

5586 AEC-tr-3531

DETERMINATION OF VOLUME SELF-DIFFUSION CONSTANTS OF IRON IN THE α PHASE BY MEANS OF RADIOACTIVE ISOTOPES. (Détermination des Constantes d'autodiffusion en Volume du Fer en Phase α à l'aide des Isotopes Radioactifs.) C. Leymonie and P. Lacombe. Translated by A. L. Monks (Oak Ridge National Lab.) from Rev. mét. 55, 524-30(1958). 13p. $4.80(ph); $2.70(mf) JCL or LC.

A review of information related to autodiffusion in metals is presented. In addition, a study was made of autodiffusion in α-iron monocrystals at 775 to 850°C and in polycrystalline samples at 850 to 900°C. The samples were coated with a mixture of Fe^{55} and Fe^{59}. The diffusion annealing was carried out in evacuated silica tubes from which all oxygen was eliminated. The autodiffusion coefficient variations with temperature are presented in tables. (J.R.D.)

5587 AEC-tr-3543

MOLYBDENUM DISILICIDE AS A HIGH-TEMPERATURE MATERIAL. Erich Fitzer. Translated from Plansee Proc. 2nd Seminar, Reutte/Tyrol, 1955, 56-79 (1956). 9p. $1.80(ph); $1.80(mf) JCL or LC.

Experiments were performed to determine the high-temperature properties of molybdenum disilicide. The work done is described; however, the data are not given. (A.C.)

5588

THE MECHANICAL PHOPERTIES OF URANIUM. G. Ya. Sergeev, V. V. Titova, E. M. Savitskii, A. A. Zhsul'kova, and Z. P. Nikolaeva. Atomnaya Energ. 5, 618-23(1958). (In Russian)

Results are presented of mechanical tests of uranium at room and elevated temperatures. Data are given on hardness in the temperature interval 20 to 600°C, stress-creep in α and γ phases, and tensile and impact strength of α, β, and γ phases up to 900°C. Mechanical tests indicated the anisotropic behavior of separate grains in large-grained uranium. It is shown that the allotropic transformations, variations in crystalline structure, and carbon content greatly affect the mechanical properties of uranium. (tr-auth)

5589

BERYLLIUM. G. A. Meerson, D. D. Sokolov, et al. Pakhomov, D. S. L'vovskii, and V. M. Schmelev. Atomnaya Energ. 5, 624-30(1958). (In Russian)

Various methods of preparing metallic beryllium were evaluated. Magnesium reduction of fluorides, electrolytic preparations, and distillation refining in vacuum are compared. Metal–ceramic technology in manufacturing, melting (in induction vacuum furnaces), and extrusion of beryllium sections and the structure and properties of beryllium compacts are discussed. It was found that specimens of pure beryllium prepared by heat-compression extrusion in vacuum at 425°C possess a maximum tensile strength of 20 kg/mm^2 expansion (elongation above 20%). (tr-auth)

5590

THE THERMODYNAMICAL PROPERTIES OF COPPER-PALLADIUM ALLOYS. A. A. Vecher and Ya. I. Gerasimov (Lomonosov Moscow State Univ.). Doklady Akad. Nauk S.S.S.R. 123, 868-9(1958) Dec. 11. (In Russian)

The free energy, enthalpy, and entropy of copper–palladium alloys were determined by measuring the electromotive forces of the galvanic element Cu/Cu^+ (halide melt) Cu–Pd alloy. Diagrams of copper and palladium activity at 1000°K and the integral heat, free energy, and entropy of Cu–Pd formation are presented. (R.V.J.)

5591

THE INFLUENCE OF QUADRIVALENT TITANIUM IONS ON THE ELECTROCHEMICAL PROPERTIES AND CORROSION BEHAVIOR OF THIS ELEMENT. V. V. Andreeva and V. I. Kazarin (Inst. of Physical Chemistry, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 123, 1048-51(1958) Dec. 21. (In Russian)

Investigations in hydrochloric and sulfuric acid solutions indicated that the quantity of Ti^{4+} necessary to keep titanium in the state of passivity depends on the concentrations of acid and temperature of the solution. (R.V.J.)

5592
TWO NEW SUPERALLOYS EXCEL AT ELEVATED TEMPERATURES. E. E. Reynolds and R. K. Pitler (Allegheny Ludlum Steel Corp., Pittsburgh). Iron Age 183, No. 4, 70-1(1959) Jan. 22.

One alloy, named D-979, has an Fe–Ni–Cr base, and the tensile and stress-rupture properties are equal to those of Ni-base high-temperature alloys that can be precipitation hardened. The metal is also readily welded. The other alloy, named AF-71, is an Fe–Mn–Cr base alloy, and its tensile and stress-rupture properties are outstanding in comparison to other more highly alloyed materials. This alloy is easily cast. (W.L.H.)

5593
THE DEVELOPMENT OF BERYLLIUM FOR NUCLEAR REACTOR APPLICATIONS. G. C. Ellis (Atomic Weapons Research Establishment, Aldermaston, Eng.). Metallurgia 58, 265-9(1958) Dec.

The development of Be as a fuel canning material for nuclear reactors is discussed. In the first part of the article the demand for Be in this field, toxic hazards, and initial production of the metal from the ore are discussed. The second part deals with the production of ingot and powder metal, fabrication and mechanical properties, and the possibility of improving the ductility. (W.L.H.)

5594
ROLLING MILL FOR PROCESSING NUCLEAR FUEL ELEMENT MATERIALS. Metallurgia 58, 286-8(1958) Dec.

The rolling mill recently completed is a Stanat-Mann 10-in. diam. by 14-in. roll face width, 2-high by 4-high combination mill. The mill incorporates the use of four separate roll configurations which are automatically and remotely interchanged. It has a 600,000-pound maximum rolling load capacity at a speed of 100 ft per minute and is equipped with an infinitely variable speed 2 hp screwdown motor drive and a 100 hp electronically controlled main mill drive. Screwdown pressure gaging and metering of the torque transmitted through the universal joint spindles have been incorporated. The mill is arranged for sealing within a glove box enclosure, the reduction gears, pinion stand, and drive motor being outside. (W.L.H.)

5595
WELDING HEAT EXCHANGERS FOR NUCLEAR POWER PLANT. Metallurgia 58, 297-8(1958) Dec.

The welding of sixteen heat exchanger vessels being fabricated for the Hunterston nuclear power station is described. (W.L.H.)

5596
PHYSICAL METALLURGY OF URANIUM. M. J. Brabers. R C N Bull. 2, 137-41(1958) Nov. (In Dutch)

The crystallography of uranium is discussed, with special emphasis on the thermal effects and neutron irradiation effects. (J.S.R.)

5597
DIAGRAM OF THE FATIGUE FAILURE OF METALS. V. S. Ivanova (A. S. Baikov Metallurgical Inst., Academy of Sciences, USSR.). Soviet Phys. (Doklady) 3, 378-81 (1958) Mar.-Apr.

On the basis of experimental data on the fatigue process, it is possible to distinguish three fatigue periods. The first period, the incubation period, is characterized by the absence of slip bands visible in the optical microscope. The second period, the disintegration period, is associated with the appearance and development of submicroscopic cracks in the slip bands. The third or failure period sets in when the submicroscopic cracks grow to the dimensions of microcracks. A fatigue failure diagram, reflecting these periods, is shown schematically. The fatigue diagram for annealed Armco iron and commercial copper is given. The relative length of each fatigue period in turn is discussed. (J.S.R.)

5598
THERMAL AND ELECTRIC PROPERTIES OF Cu, Ag, Au, Al, AND Cu–Be ALLOYS. V. E. Mikryukov (Dept. of Molecular Physics). Vestnik Moskov. Univ. Ser. Mat. i Mekh. 12, No. 6, 57-67(1957) (In Russian)

The temperature dependence of thermal and electrical conductivity of pure polycrystals of Al, Ag, Au, Cu, and Cu–Be alloys was measured at low and elevated temperatures. (R.V.J.)

5599
MICRO TENSION TESTS FOR THE INVESTIGATION OF THE "PRESS EFFECT" IN COLD AND HEAT TREATED ALUMINUM–COPPER–MAGNESIUM ALLOYS. Werner Dickenscheid and Hugo Josef Seemann (Univ. of Saarlandes, Saarbrucken). Z. Metallk. 49, 527-32(1958) Oct. (In German)

Extruded aluminum–copper–magnesium alloys of the duralumin type, which have retained the extrusion texture during the solution treatment, display very high yield and tensile strengths in the longitudinal direction of the material whereas the strength in the transversal direction is quite normal. Longitudinal and transversal specimens of such alloys were tested with a microtensile machine of the Chevenard type in the quenched, cold-aged, warm-aged, and overaged condition. The effect can be described by the ratio v of the longitudinal to the transversal yield (tensile) strength. If the effect exists, v is approximately 1.2 to 1.3 and remains constant during cold aging and also during warm aging until maximum hardness has been attained. In the overaged condition v becomes 1, i.e., the effect disappears. This is possible due to influences of precipitation particles on the deformation mechanism, which are not yet known. (auth)

5600
STRUCTURE OF THE GOLD CORNER OF THE GOLD–CADMIUM–INDIUM ALLOY SYSTEM. Jörg Wegst and Konrad Schubert (Max-Planck-Institut für Metallforschung, Stuttgart). Z. Metallk. 49, 533-44(1958) Oct. (In German)

The 350° section of the gold corner of the system gold–cadmium–indium contains only structures which can be derived from close-packed spheres. Superstructures are formed by a shift mechanism in the hexagonal close-packed layers. The observed axial ratios correspond to the ratios expected from the band model. The observed densities of shifts correspond to a relation derived from the $L1_2Vw$ structure. The whole phenomenological picture confirms the existence of long ranging bonds. (auth)

5601
THE EFFECTS OF DEFORMATION ON THE MECHANICAL PROPERTIES OF AN AGED ALUMINUM ALLOY. Herbert Richter and Günter Wassermann (Institut für Metallkinde der Bergakademie, Clausthal, [Ger.]). Z. Metallk. 49, 549-56(1958) Nov. (In German)

Samples of an aluminum–copper–magnesium alloy

were age-hardened at different temperatures, with special regard to overaging. Tension tests and hardness measurements were performed, and strain-hardening curves were taken at different stages. The results are discussed critically. (auth)

5602

ROLLED AND RECRYSTALLIZATION TEXTURE OF TANTALUM. Herbert Müller (Univ. of Vienna). Z. Metallk. 49, 575-7(1958) Nov. (In German)

A cold-rolled sheet of tantalum showed a preferred orientation which may be described by the ideal orientations (100) [011] and (112) [1$\bar{1}$0]. Two further ideal orientations of weak intensity, (111) [11$\bar{2}$] and (111) [110], exist. Annealing only causes a slight intensification of the rolling texture, especially of the (111) [11$\bar{2}$]-orientation. (auth)

5603

INVESTIGATIONS IN THE TANTALUM–NITROGEN SYSTEM. Erich Gebhardt, Hans-Dieter Seghezzi, and Wolfgang Dürrschnabel (Max-Planck-Institut für Metallforschung, Stuttgart). Z. Metallk. 49, 577-83(1958) Nov. (In German)

Recrystallized specimens of tantalum were loaded with different amounts of nitrogen in a homogeneous solution. These samples were used to study the dependence of hardness, tensile strength, yield point, dilatation, lattice parameter, electrical resistivity, and internal friction on the nitrogen concentration. Investigations were carried out concerning the solubility of nitrogen in tantalum and the processes that occur when an oversaturated solid solution is cooled to room temperature. (auth)

5604

MAGNETIC MEASUREMENTS ON GOLD–IRON ALLOYS. Erich Scheil, Hansgeorg Specht, and Ernst Wachtel (Max-Planck-Institut für Metallforschung, Stuttgart). Z. Metallk. 49, 590-600(1958) Nov. (In German)

A single-phase reaction was found to occur in the gold-rich mixed crystals of the system gold–iron. This reaction could be separated distinctly from the precipitation of the α-iron mixed crystals. The change of state in a homogeneous phase changes the Curie temperature while the number of Bohr magnetons remains approximately constant. From an alloy with 25 at. % Fe, a number of 2.8 μ_B for one solute iron atom was calculated. It was found that the reaction is influenced by residual stresses. Magnetic creep was observed during saturation measurements. (auth)

5605

OCCURRENCE OF TERNARY CARBIDES IN THE TREATMENT OF LIQUID ZINC AND IRON–CARBON SYSTEMS. Leo J. Hütter and Hans H. Stadelmaier (North Carolina State Coll., Raleigh). Z. Metallk. 49, 600-1(1958) Nov. (In German)

In the reaction between iron–carbon and molten zinc a ternary carbide Fe_3ZnC is formed on the iron surface, together with the familiar binary iron–zinc phases. This carbide, which is embedded in the δ_1 layer, has an ordered face-centered cubic lattice with a lattice constant of 3.80 kX. (auth)

5606

SUPERSTRUCTURE AND K STATE IN THE NICKEL–CHROMIUM SYSTEM. Hans Günter Baer (Laboratorium der Vacuumschmelze AG., Hanau, Ger.). Z. Metallk. 49, 614-22(1958) Dec. (In German)

In the nickel–chromium system a superstructure Ni_2Cr was detected, which exists between approximately 25 and 36 at. %. For the alloy with 33.7 at. % chromium the critical ordering temperature is 580 degrees. At cooling the transformation occurs just below 500 degrees. Order is destroyed by cold working. The resistivity increases. On the other hand, for alloys with lower chromium concentration, which form the K state, resistivity decreases. The solubility line for chromium is newly determined. (auth)

5607

CARBIDE PHASES OF TANTALUM. Richard Lesser and Georg Brauer (Univ. of Freiburg i. B.). Z. Metallk. 49, 622-6(1958) Dec. (In German)

In the tantalum–tantalum carbide system the phases α, β, ζ, and δ were detected between 1800 and 2100 degrees. Their structure was determined except for the ζ phase, and the range of existence of these phases is given. For the β and δ phase the dependence of the lattice parameter on concentration was measured. (auth)

5608

THE MEANING OF THE Δ_α EFFECT IN IRON–NICKEL ALLOYS. Gerhard Pupke and Hans-Joachim Bunge (Forschungs- und Entwicklungsstelle des Walzwerkes, Hettstedt and Deutschen Akademie der Wissenschaften, Berlin). Z. Metallk. 49, 626-9(1958) Dec. (In German)

After cold rolling iron–nickel invar alloys show different coefficients α of thermal expansion parallel and perpendicular to the rolling direction (Δ_α-effect). For sheets with a cube texture, the dependence of α on the angle between rolling direction and [100]-direction was measured. For explanation the alteration of short range order is considered. The angular dependence calculated on this basis agrees satisfactorily with experiment. (auth)

5609

THE TWO-COMPONENT PALLADIUM–VANADIUM SYSTEM. Werner Köster and Wolf-Dieter Haehl (Max-Planck-Institut fur Metallforschung, Stuttgart). Z. Metallk. 49, 647-9(1958) Dec. (In German)

The palladium–vanadium system was investigated by thermal and dilatometric analysis. The metals form a eutectic series of alloys. Solid solutions with approximately 58 and 62.5 at. % vanadium take part in the eutectic reaction. The miscibility gap broadens as temperature decreases. At 840 degrees PdV_3, with a β-tungsten structure, is formed by peritectoid reaction. In the range of homogeneous palladium solid solutions the superstructures Pd_3V and Pd_2V with a tetragonal face-centered lattice form below 815 and 905 degrees, respectively. (auth)

5610

THE EFFECT OF TENSILE STRESS ON THE RESIDUAL MAGNETISM OF α IRON AT HIGH TEMPERATURES. B. J. Shepstone and L. Alberts (Univ. of Oranje-Freistaates, Bloemfontein, South Africa). Z. Naturforsch. 13a, 1096-1100(1958) Dec. (In German)

The magnetic properties of α iron under different stresses was measured at temperatures from 611 to 741°C. The results, which are tabulated, show a satisfactory agreement between theory and experiment for the temperatures between 600 and 700°C. (J.S.R.)

5611

THE ELECTROCHEMICAL AND CORROSION BEHAVIOR OF STEEL AND NICKEL ELECTRODES IN SUL-

FURIC ACID SOLUTIONS SUBJECTED TO THE ACTION OF γ-RAYS. N. Ya. Bune, Ya. M. Kolotyrkin, and G. S. Tyurikov (Karpov Inst. of Physics and Chemistry, Moscow). Zhur. Fiz. Khim. 32, 2679-85(1958) Dec. (In Russian)

A study was made of the action of γ radiation on the electrochemical and corrosion behavior in 1N H_2SO_4 of type 18-8 steel and of nickel, the radiation intensity being 1.5×10^{15} ev/ml sec. For these metals the effective radiolysis components were found to be those with oxidizing properties. It was established that the effect of the radiation on the rate of solution of the metal depends upon its capacity for passivation. For easily passivated metals (steel) the superposition of radiation leads to a decrease in the dissolution rate, for difficultly passivated metals (nickel) an increase in the rate takes place. The presence of iron ions in the solution leads to an increase in the oxidizing efficiency of the radiation. (tr-auth)

5612

STUDY OF VOLUME-GRADIENT THERMO-emf AND HEAT CONDUCTIVITY IN GERMANIUM SINGLE CRYSTALS WITH DEFINITE CRYSTALLOGRAPHIC ORIENTATION. P. I. Baranskii and N. S. Konoplyasova (Inst. of Physics, Kiev). Zhur. Tekh. Fiz 28, 1621-30 (1958) Aug. (In Russian)

The volume-gradient of thermo-emf developed in the volume heterogeneities of germanium was studied. The temperature processes of the thermoelectrical forces and the isotropic thermal conductivity of germanium monocrystals were determined. (R.V.J.)

5613

THERMOELECTRIC PROPERTIES OF CERTAIN METAL-LIKE COMPOUNDS. N. V. Kolomoets, V. S. Neshpor, G. V. Samsonov, and S. A. Semenkovich. Zhur. Tekh. Fiz. 28, 2382-9(1958) Nov. (In Russian)

The thermoelectric properties of carbides, nitrides, borides, and silicides of transition metals (NbC, TaC, TiC, WC, ZrC, TaN, TiN, NbB, TaB_2, TiB_2, VB_2, ZrB_2, Mo_2B_5, W_2B_5, NiS_2, and $FeSi_2$) were investigated in the temperature interval 300 to 1400°K. (R.V.J.)

5614

ON SOME PECULIARITIES IN ELECTRICAL PROPERTIES OF CERAMIC DIELECTRICS OF ZIRCONIUM AND NIOBIUM OXIDES. K. E. Lisker. Zhur. Tekh. Fiz. 28, 2428-33(1958) Nov. (In Russian)

Properties of $ZrO_2-Nb_2O_5$, in which one component, ZrO_2, has sufficiently stable and low dielectric losses and the other, Nb_2O_5, has a high dielectric penetrability and large dielectric losses, were investigated. (R.V.J.)

5615

EXPERIMENTS ON AN IMPROVED METHOD FOR THE PREPARATION OF URANIUM METAL. A. Cacciari, R. De Leone, et al. (CISE, Milan). pp. 297-343 in "Atti del Congresso Scientifico. Volume I. Sezione Nucleare, Giugno 1957." (In Italian)

An economic method, easily adaptable to industrial applications, is described for the production of uranium from raffinate solutions by organic solvent extraction. The thermal reduction of the raffinate solution, the wet preparation of uranium tetrafluoride and of double fluorides of uranium and another cation, conversion of the uranyl nitrate to sulfate or chloride by ion exchange, and the analytical control of the process are described in detail. (J.S.R.)

5616

HISTORY OF THE PRODUCTION OF URANIUM IN FRANCE. H. Huet (Commissariat a l'Energie Atomique, France). pp. 345-62 in "Atti del Congresso Scientifico. Volume I. Sezione Nucleare, Giugno 1957." (In French)

A brief survey is made of the development of techniques for the production of uranium metal in France. The process followed at the Bouchet plant is described. (J.S.R.)

5617

PYROMETALLURGICAL TREATMENTS OF NUCLEAR FUELS. Jean Petit (Commissariat a l'Energie Atomique, Saclay, France). pp. 363-79 in "Atti del Congresso Scientifico. Volume I. Sezione Nucleare, Giugno 1957." (In Italian)

The pyrometallurgical processing of irradiated nuclear fuel is reviewed. The processes used in this treatment include distillation, fractional crystallization, liquid-liquid extraction with molten metals, formation of oxides, formation of halides, electrolysis, and the iodide of the Van Arkel process, and each is briefly discussed. The potential value of pyrometallurgical procedures is considered with respect to the decontamination efficiency, the products obtained, and the installations needed. A brief description is given of pilot plants in the United States which process irradiated fuels by pyrometallurgical techniques. (J.S.R.)

5618

SOME ASPECTS OF THE FABRICATION OF CERAMIC AND METAL-CERAMIC FUEL ELEMENT. J. Williams (United Kingdom Atomic Energy Authority, Harwell, Berks, Eng.). pp. 381-98 in "Atti del Congresso Scientifico. Volume I. Sezione Nucleare, Giugno 1957."

Improvements in the performance of gas cooled reactors are apt to come from increased operating temperatures. Therefore, there is increased interest in the use of ceramic fuel elements. Studies have centered on the dioxide and monocarbide of uranium. The properties of each and the effect of preparation on these properties are discussed. The use of metal-ceramic fuel elements was also investigated. Studies in the fabrication of iron-uranium oxide systems and aluminum-uranium oxide systems are reported. The stability of metal-ceramic systems is briefly discussed. (J.S.R.)

5619

REFRACTORIES BIBLIOGRAPHY, 1947-1956. Norman, Okla., University of Oklahoma Press, 1959. 1826p. $7.50.

This volume contains over 9,500 references to the periodical literature and to U. S. and foreign patents on refractories. The references contained in this compilation relate to raw materials, manufacture, properties, and uses of refractories. Refractories in all phases of industrial use have been covered, including the glass, petroleum, foundry, iron, and steel industries. (W.L.H.)

PARTICLE ACCELERATORS AND HIGH-VOLTAGE MACHINES

5620 AECU-3926

Northwestern Univ., Evanston, Ill. Nuclear Physics Research Lab.

COMPLETION OF THE ELECTROSTATIC ACCELERATOR AND ALLIED EQUIPMENT. Final Report.

E. N. Strait and S. M. Shafroth. Nov. 26, 1958. 27p. Contract AT(11-1)-302. $4.80(ph OTS); $2.70(mf OTS).

The construction of a 5-Mev electrostatic accelerator, auxiliary equipment, and instrumentation is presented. (W.L.H.)

5621 CERN-58-13
European Organization for Nuclear Research, Geneva.
BEAM STORAGE WITH STOCHASTIC ACCELERATION AND IMPROVEMENT OF A SYNCHRO-CYCLOTRON BEAM. R. Keller and K. H. Schmitter. Dec. 1958. 41p.

Beam storage with stochastic acceleration in the CERN synchrocyclotron is studied. Computation of the intensity, beam stacking, and improvement of beam intensity is discussed. A test of stochastic acceleration with an analog model is described. The beam storage equipment for the 600-Mev CERN synchrotron is calculated. This equipment consists of an auxiliary dee of 40 cm radius, a feeder-line for the connection between the auxiliary dee and noise generator, and an RF noise power-generator. (W.D.M.)

5622 CERN-PS/AC-5
European Council for Nuclear Research, Geneva.
ON A POSSIBLE EJECTION SCHEME. A. Citron. July 7, 1954. 22p.

An ejection scheme is described. Requirements for a good scheme include the provision for extraction of a high fraction of the particles circulating in the vacuum chamber. In addition, the outcoming beam must have a geometry which lends itself to lens capture, and the pulse should be about 1 millisecond. With these requirements as a basis, a scheme is developed using LiH as an example of a light target and Au as an example of a heavy target. It is concluded that a thick target is the source of most losses, and it is pointed out that although an electrostatic field could be substituted, it would require a field strength of 6.5×10^5 v/cm. A more complicated scheme involving lower fields might be envisaged. (J.R.D.)

5623 CERN-PS/CS-8
European Council for Nuclear Research, Geneva.
A FREQUENCY INDEPENDENT PHASE SHIFTING SYSTEM. Ch. Schmelzer and J. Geibel. June 15, 1953. 6p.

A method of phase shifting by use of a heterodyne oscillator is presented. Separate mixers are provided for each channel, and the voltage of variable frequency is fed in phase into all mixers. The fixed frequency enters the respective mixers after having passed suitable phase-shifting elements. The phase-shifting system consists of a delay line tapped at suitable points by the grids of cathode followers, which in turn feed the individual mixers over R-C coupling elements. Diagrams and mathematical relationships are included. (J.R.D.)

5624 CERN-PS/CS-9a
European Council for Nuclear Research, Geneva.
NOTE ON THE APPLICATION OF THE HALL EFFECT TO COMPUTE THE FREQUENCY PROGRAM FOR A PROTON–SYNCHROTRON. Ch. Schmelzer and W. Schnell. June 30, 1953. 6p.

A method for computing the frequency program is described. The computer produces an a-c voltage which varies with respect to the intensity of the proton synchrotron guiding magnetic field. Any generator which may be made to follow the a-c voltage in frequency linearly may be used directly with the computer. The computer controls the frequency of a nuclear resonance controlled generator through the whole accelerating cycle by setting up a magnetic field controlled by, and varying linearly with, the a-c voltage. (J.R.D.)

5625 MURA-441
Midwestern Universities Research Assn., Madison, Wis.
ON THE INSTABILITY OF A COASTING BEAM. C. E. Nielsen and A. M. Sessler. Jan. 1, 1959. 18p. Contract AT(11-1)-384. $0.50(OTS).

The time-dependent Boltzmann equation is used to study longitudinal motion of particles in a circulating beam of particles. The equation is linearized about the stationary solution corresponding to a coasting beam of almost monoenergetic particles to determine the effect of small density fluctuations. An integral equation is obtained and solved, leading to a dispersion relation quite similar to that well known in the theory of plasma oscillations. It is shown that if the accelerator is operating above the transition energy, then the motion can be unstable. Expressions are given for the rate of growth of longitudinal waves, and it is shown that if the unperturbed beam satisfies certain criteria, then the motion is either stable or it grows at such a slow rate as to be of no consequence. Numerical examples for MURA particle accelerators show that essentially there is stability. (auth)

5626 ORNL-2648
Oak Ridge National Lab., Tenn.
THE OAK RIDGE RELATIVISTIC ISOCHRONOUS CYCLOTRON. R. S. Livingston and F. T. Howard, comps. and eds. Sept. 1958. 131p. Contract W-7405-eng-26. $2.75(OTS).

This document was originally submitted in support of the proposal to the AEC for the construction of the cyclotron. Corrections and minor changes in title and terminology have been made, and the document is now being issued for general distribution. Novel features incorporated into the ORIC to provide the greatly enlarged research potential which now appears practical for a fixed-frequency cyclotron in the intermediate energy field are described. (W.D.M.)

5627 UCRL-8598
California. Univ., Berkeley. Lawrence Radiation Lab.
ORBIT DYNAMICS IN THE SPIRAL-RIDGED CYCLOTRON. Lloyd Smith and Alper A. Garren. Jan. 12, 1959. 30p. Contract W-7405-eng-48. $0.75(OTS).

Formulas are derived for the equilibrium orbit, isochronous condition, vertical and horizontal betatron frequencies, and for the effects of the $^3/_3$ radial resonance in a three-fold geometry. The magnetic field is represented by a Fourier series in azimuth with amplitudes expanded in a Taylor series about the reference radius. The form is such that the various parameters may be deduced from an arbitrary set of field measurements in the median plane and the results obtained by direct substitution in algebraic formulas. (auth)

5628 AEC-tr-3525
EXPERIMENTAL STUDY OF A PULSE SYSTEM ION GUN. (Etude Experimentale d'un Canon a Ions Fonctionnant en Regime Pulse.) J. Guidini. Translated for Oak Ridge National Lab. from Report CEN.S.PA 7.969, June 23, 1958. 39p. (Includes Original, 25p.) $6.30(ph); $3.00(mf) JCL or LC.

A pulsed ion gun capable of producing a proton beam of about 15 ma is described; the ion gun can be adapted on the Van de Graaff–Saturn injection. The general scheme of the source is described, and discussion of accelerator regulation, current measurement, and

charge capacity measurements are presented. Various factors affecting discharge are discussed, and it is concluded after 50 hours that the operation is stable. (J.R.D.)

5629 NP-tr-214

THE EFFECT OF GAS SCATTERING ON SYNCHROTRON OSCILLATIONS OF PARTICLES IN ACCELERATORS. D. G. Koshkarev. Translated by P. Collins (U.K.A.E.A., Atomic Energy Research Establishment) from Pribory i Tekh. Ekspt., No. 2, 15-18(1957). 9p. $1.80(ph); $1.80(mf) JCL or LC.

The effect of nonelastic scattering on the synchrotron oscillation of particles in circular proton accelerators is investigated. The effect is calculated to linear approximation. The formulas for evaluation of the fraction of lost particles (neglecting damping of the oscillation) and for the increase of the mean square of the amplitude of the phase oscillations are obtained. From the formulas it is seen that the losses arise at small energies. The magnitude of the effect depends on a number of the accelerator parameters, but apparently in actual accelerators does not exceed the effect of the elastic scattering on the betatron oscillations. (auth)

5630

SOME EXPERIMENTS WITH ELECTROSTATIC ACCELERATORS OF LOW ENERGY. J. Felici. Bull. inform. sci. et tech. No. 14, 23-30(1958) Feb. (In French)

The 600-kev electrostatic accelerator at Grenoble is described. The tube structure and the electron conversion are briefly discussed. A more detailed consideration is given to the aluminum electron windows. (J.S.R.)

5631

THE PRODUCTION OF BREMSSTRAHLUNG BY THE INTERNAL TARGET OF A BETATRON. G. Harigel, H. Kulenkampff, et al. (Univ. of Würzburg, Ger.). Naturwissenschaften 45, 508-9(1958). (In German)

The production process for bremsstrahlung by the internal target of the University of Würzburg 35-Mev betatron was investigated. The investigations were made with Cu foils 60 μ thick. An analysis of the activation distribution gave, for the average number of 30-Mev electrons passing through the foil, a value of 6.5. The production of bremsstrahlung by cylindrical targets of Al and Pt was clarified by an analysis of the angular distribution of the radiation emitted. The results for the Pt target are graphed. (J.S.R.)

5632

ENERGY DISTRIBUTION IN THE BREMSSTRAHLUNG SPECTRUM OF A 35-Mev BETATRON. H. Kulenkampff, M. Scheer, et al. (Univ. of Würzburg, Ger.). Naturwissenschaften 45, 509(1958). (In German)

The spectral energy distribution of the x bremsstrahlung, which was produced by the internal target of the 35-Mev betatron at the University of Würzburg, was determined for the emission direction of 0° against the electron radiation. The results obtained with the Pt target are given and compared with the results from an Al target. (J.S.R.)

5633

THE APPEARANCE OF INSTABILITY AT LARGE GRADIENT IN STRONG FOCUSING ELECTRON ACCELERATOR. Yu. F. Orlov and E. K. Tarasov. Pribory i Tekh. Ekspt. No. 6, 15-18(1958) Nov.-Dec. (In Russian)

Instability in betatrons appearing at large gradients was investigated. The effect originates as the result of simultaneous action of radiation and resonance irregularities in magnetic fields. (tr-auth)

5634

PARAMETRIC RESONANCES OF PHASE OSCILLATIONS IN SYNCHROTRONS. D. G. Koshkarev and Yu. F. Orlov. Pribory i Tekh. Ekspt. No. 6, 19-22 (1958) Nov.-Dec. (In Russian)

The instability of phase oscillations traveling through many parametric resonances is evaluated. Conditions of stability and nonlinear effects are determined. (tr-auth)

5635

CONSIDERATION OF THE RADIATION DRAG IN THE CALCULATION OF SHIFT ON A TARGET OF ELECTRONS ACCELERATED IN A BETATRON. V. M. Razin (Tomsk Polytechnic Inst.). Zhur. Tekh. Fiz 28, 1845-8(1958) Aug. (In Russian)

The shift of accelerated electrons on a betatron target was calculated with considerations for the electron orbit contraction during electromagnetic emission at high acceleration along the orbit. The problem of compensating for bremsstrahlung is somewhat similar to the problem of electron shift on the target. A method is suggested for combining the processes used in problems of loss compensations. A longer pulse (in comparison to the normal shift pulse time) of accelerated magnetic flux of semisinusoidal shape is introduced in such a way that a slow orbit expansion takes place instead of equilibrium orbit contraction. The expansion must be calculated in such a manner that the accelerated electrons reach the target at a given moment. Mathematical analysis of the method is given. (R.V.J.)

5636

ON THE THEORY OF FOCUSING IN ACCELERATORS WITH A PERIODIC AZIMUTHAL MAGNETIC FIELD. Yu. V. Vandakurov. Zhur. Tekh. Fiz. 28, 2567-82 (1958) Nov. (In Russian)

Approximate solutions were derived for differential equations of trajectories in certain types of fields. It was assumed that the ratio of mean equilibrium orbit radius to the curvature radius is small compared to the number of periodicity elements and that the mean radius of the orbit is close to the radius of the circumference, which should be the average orbit in azimuth fields. Several types of fields were investigated as well as fields produced by various conductors with currents. (tr-auth)

5637

ON SOME PECULIARITIES IN A HIGH FREQUENCY SYNCHROTRON SYSTEM WITH A HIGH NUMBER OF ELECTRONS ACCELERATED AT A CYCLE. L. B. Kaminir and G. N. Orlovskii. Zhur. Tekh. Fiz. 28, 2583-6(1958) Nov. (In Russian)

The influence of accelerated electrons on the high-frequency accelerating system in a high-energy synchrotron was investigated. It is shown that along with the active load in the feeding generator produced by accelerated electrons, it is also necessary to consider the reactive load. It is also indicated that the division of acceleration into separate parts induces energy losses due to the positive resonator excitation by accelerated electrons. Means are shown for reducing such losses. (R.V.J.)

5638

THE ELECTRONIC SYSTEM OF THE 10 bev SYNCHROPHASOTRON OF THE JOINT INSTITUTE OF NUCLEAR

RESEARCH. A. Vassiliev. pp. 259-76 in "Atti del Congresso Scientifico. Volume I. Sezione Nucleare, Giugno 1957." (In Italian)

The electronic system of the 10-Bev synchrophasotron of the Joint Institute of Nuclear Research is discussed. A block diagram is given of the general electronic system. The control system which relates the intensity of the magnetic field to the frequency of the accelerating electron field is discussed in some detail. (J.S.R.)

PHYSICS AND MATHEMATICS

General

5639 AECU-3379

Illinois. Univ., Urbana. Digital Computer Lab.

TECHNICAL PROGRESS REPORT. PART I. STUDY PROGRAM ON HIGH SPEED COMPUTER. PART II. MATHEMATICAL RESEARCH AND PROGRAMMING. PART III. MATHEMATICAL ANALYTICAL PROGRAM. PART IV. ILLIAC USE AND OPERATION—GENERAL LABORATORY INFORMATION. Sept. 1956. 22p. Contracts AT(11-1)-415; N6ori-07130; and N6ori-07124. $4.80(ph OTS); $2.70(mf OTS).

Work on a study program on high-speed computers is reported. Computer programming is discussed. ILLIAC use and operation are summarized. (For preceding period see AECU-3373.) (W.D.M.)

5640 AECU-3936

General Electric Co. General Engineering Lab., Schenectady, N. Y.

AN EXPERIMENTAL EVALUATION OF THE CRITICAL FLOW VELOCITY FORMULAS FOR PARALLEL PLATE ASSEMBLIES. W. L. Zabriskie. Oct. 31, 1958. 42p. (58-GL-297). $7.80(ph OTS); $3.30(mf OTS).

The design and construction of a facility for determining collapse velocities in parallel-plate fuel assemblies are described. In addition, the instrumentation used and the experimental method of collapse determination are described. The test results are presented in summary sheets showing all plate parameters, the predicted collapse velocity, and the measured collapse velocity. (J.R.D.)

5641 AECU-3973

Michigan. Univ., Ann Arbor.

STUDIES WITH AN X-RAY MONOCHROMATOR. Final Report. H. J. Gomberg and J. L. Garsou. July 1958. 31p. Contract AT(11-1)-434. $6.30(ph OTS); $3.00 (mf OTS).

A relationship between the x-ray absorption spectrum and the radiation damage spectrum of iodoform and of pentabromoethane was found. (T.R.H.)

5642 AECU-3975

Illinois. Univ., Urbana. Digital Computer Lab.

TECHNICAL PROGRESS REPORT. PART I. HIGH-SPEED COMPUTER PROGRAM. PART II. SWITCHING CIRCUIT THEORY. PART III. MATHEMATICAL METHODS. PART IV. ILLIAC USE AND OPERATION—GENERAL LABORATORY INFORMATION. Nov. 1958. 23p. Contracts AT(11-1)-415 and Nonr-1834(15). $4.80(ph OTS); $2.70(mf OTS).

Components, test units, and basic circuits for the high-speed computer program are described. Semimodular circuit theory and information transfer in asynchronous circuits are discussed. Work is reported on iterative methods for solving systems of linear equations. Operation and use of the ILLIAC are summarized. (See also AECU-3918.) (W.D.M.)

5643 AERE-E/M-35

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE STABILITY OF GAS BEARINGS. J. Woodrow. July 11, 1950. 2p.

In gas bearings involving divergent flow, a rise in pressure along the channel due to the Bernouilli effect is superimposed on the pressure drop due to viscosity. Under certain conditions this leads to an unstable gas film. A preliminary investigation into this effect was made and is presented. (W.L.H.)

5644 AERE-T/M-168

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

QUANTAL RESPONSE ANALYSIS (PROBIT ANALYSIS) PROGRAM FOR MERCURY COMPUTER. B. E. Cooper. Nov. 1958. 16p.

The aim of this Memorandum is to outline the methods of Quantal Response Analysis and to indicate its superiority over a simple least squares fit. A general program to carry out the analysis has been written for the Ferranti Mercury Computer so that the analysis presents only the simple task of preparing a data tape. The time taken for one case is about 1 minute. Section I describes the method of the analysis and the statistical tests applied to the results obtained. Sections II and III describe details of the use of the Mercury Program and details of the statistics in Section I, respectively. Section III may be omitted by those who wish only to follow the analysis and are willing to accept Section I without question. (auth)

5645 ANL-5954

Argonne National Lab., Lemont, Ill.

APPLIED MATHEMATICS DIVISION SUMMARY REPORT [FOR] NOVEMBER 1956 THROUGH JUNE 1958. Dec. 1958. 81p. Contract W-31-109-eng-38. $2.25 (OTS).

The status of various projects undertaken to assist other scientists at ANL is reviewed. (T.R.H.)

5646 APEX-416

General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.

AN IDENTITY WHICH REDUCES A SUM OF PRODUCTS TO A SIMPLE PRODUCT. Task 7371—Problem 7-1156. J. A. Delaney. Aug. 21, 1958. 13p. (XDC-58-8-224). $3.30(ph OTS); $2.40(mf OTS).

In investigating a general solution for the differential equations of radioactive decay, a suspected identity was found. The proof is offered. (T.R.H.)

5647 APEX-418

General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.

BARE REACTOR PROGRAM (IBM 704 PROGRAM C_2). Deborah B. Vollenweider. July 1957. 79p. Contracts AF33(600)-38062 and AT(11-1)-171. $2.25(OTS).

Program C_2 provides a multigroup analysis for a bare, homogeneous, cylindrical reactor. The input data consist of geometric and composition variables defining the reactor configuration; cross section data are supplied on the nuclear data tape. Macroscopic cross sections are computed for specified regions; flux and slowing-down density are then calculated for the homogeneous core. Reactivity and two-group constants constitute the main output of the program. Program I_2 has

been incorporated into program C_2 and can be used to compute the thermal cell correction for the fuel region. (auth)

5648 APEX-452
Computer Usage Co., Inc., New York.
CURE: A TWO-SPACE-DIMENSION, MULTI-GROUP CODE FOR THE IBM-704. F. M. Trantham, Jr. Aug. 12, 1958. 131p. For General Electric Co. Aircraft Nuclear Propulsion Dept. Contracts AF33(600)-38062 and AT(11-1)-171. $2.75(OTS).

Two new versions of the CURE Code designed to take advantage of the 32,000 word machine are given. The original CURE Code, made available in June 1957, was for an 8000 word, 6-tape IBM 704 and handled 644 collapsed mesh points. The first of the two new versions utilizes the additional core memory to quintuple the number of mesh points allowable. It will handle from 1 to 50 groups. The second of the two new versions utilizes the additional core memory to double the number of mesh points allowance, reduce (from 6 to 3) the number of tape units required, approximately halve the running time per power (outer) iteration and reduce tape errors to the vanishing point. It will handle from 1 to 3 groups. Both versions incorporate a number of refinements not present in the original code. Also, both versions incorporate the Shinn version of the Peaceman-Rachford flux iteration block that is estimated to run approximately 16% faster than the original version. (auth)

5649 CERN-58-21
European Organization for Nuclear Research, Geneva.
NUMERICAL VALUES OF INTERFERENCE BREMSSTRAHLUNG FROM COPPER AND SILICON CRYSTALS. H. Uberall. Sept. 1958. 15p.

Numerical results related to the angular distribution of the interference radiation are presented along with a discussion of its dependence on the incidence angle of the electron beam. The possibility of a more intense source of gamma rays from the presently available high-energy electron accelerators than the one represented by amorphous target bremsstrahlung is considered. Copper crystals were found to be of little experimental value; instead, single silicon crystals were successfully used. (J.R.D.)

5650 CRP-746
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
THE ABSOLUTE STANDARDIZATION OF RADIOISOTOPES BY THE BETA-GAMMA COINCIDENCE METHOD USING HIGH EFFICIENCY DETECTORS. P. J. Campion. Jan. 1958. 49p.

The corrections pertaining to absolute disintegration rate determinations by the 4π β-γ coincidence method are discussed. It is demonstrated that because of the high efficiency of the 4π detector most corrections are small. In general, the largest corrections, apart from background, are those due to the accidental coincidence rate and dead time losses, expressions for which are derived. A 4π β-γ coincidence apparatus which was developed in this laboratory is described. An account of the performance of this instrument is given together with the experimental verification of the accidental coincidence rate and dead time corrections. (auth)

5651 CU-176
Columbia Univ., New York. Pupin Cyclotron Lab. and Columbia Univ., New York. George B. Pegram Lab.
PROGRESS REPORT FOR APRIL, MAY, JUNE 1958 TO THE UNITED STATES ATOMIC ENERGY COMMISSION. 52p. Contract AT-30-1-GEN-72. $7.80(ph OTS); $3.30(mf OTS).

Neutron Physics. The Nevis neutron velocity spectrometer was used to obtain more data on resonance levels in U^{235}. The "flat detector" for the velocity selector was tested on the Nevis cyclotron. A new high-pressure gas scintillation chamber is described. Helium-3 proportional counter development continued. Improvements on the Columbia neutron crystal spectrometer are discussed. The neutron-reflecting properties of Ge are investigated. The absolute fission cross section of U^{235} was measured as 581 ± 7 barns at 0.0253 ev. The stoichiometry of yttrium hydrides was studied. Charged Particle Investigations. Cyclotron modifications are reported. Experiments to determine the ground state of F^{20} and a 22-Mev excited state in He^4 are described. The intermediate image pair spectrometer was used to measure pairs from monopole and gamma transitions in several light nuclei. Gamma transitions in O^{16} were investigated. Data are given for gamma energies from deuteron bombardment of Al^{27} and Na^{23}. Alpha elastic scattering by O^{16} and proton capture in N^{15} were studied. The $Ne^{20}(d,n)Na^{21}$ reaction was studied to find the levels in Na^{21} and assign spins and parities. Steering magnet and magnet regulator construction for the Van de Graaff generator is reported. Construction of a 19-ft thermal diffusion column is described. Instrument Development. Design studies of a multichannel analyzer for the double-focusing reaction product spectrometer are reported. A pulse-height selector is described which is for use with the 2000-channel velocity spectrometer. Design work on the Van de Graaff scattering chamber drives is discussed, and brief reports of other instrument work are made. The circular polarization of Co^{60} gamma rays was measured. Internal bremsstrahlung from Fe^{55} was studied. A beta recoil experiment on He^6 is discussed. The ft value for Ca^{39} was studied. (For preceding period see CU-174.) (T.R.H.)

5652 D-21635
Boeing Airplane Co., Seattle.
DESCRIPTION OF BOEING COBALT-60 GAMMA FACILITY. Howard L. Steele and John A. Barton. July 23, 1957. 39p. (AD-155463).

Design and operational data are presented for a 600-curie cobalt-60 gamma radiation facility used to study the effect of gamma radiation on materials, components, and systems used in aircraft. (C.H.)

5653 GRL-TR-9
Giannini Research Lab., Santa Ana, Calif.
PROPULSIVE PROPERTIES OF HIGH INTENSITY PLASMA JETS. A. C. Ducati and G. L. Cann. Feb. 21, 1958. 146p. Project No. 37507. Contract AF49(638)-54. (AFOSR-TN-57-748; AD-136736).

A continuously operating plasma generator has been developed and experimental investigations of high-intensity ionic propulsive jets have been conducted. A primary investigation of the propulsive properties indicated that specific impulses of 200 and 500 could easily be obtained for argon and helium, respectively, as a result of the direct transfer of electrical energy to the gas. Electrode and nozzle configuration was found to have a definite effect on the ratio of internal energy in the gas to ionization energy at the front exit area. Practically all of the energy in the form of non-equilibrium ionization can be assumed to be transferred to the random particle motion and direct kinetic energy of the gas. The radiated energy is to some extent in-

cluded in the energy absorbed by the cooling system. The radiation measured externally to the generator was found to be approximately 5 per cent of the input electrical energy. A limited number of mixing experiments have been performed. (auth)

5654 HW-58156
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
MODEL FOR DETERMINATION OF THE "EPITHERMAL RATIO" IN WESTCOTT'S NOTATION. Clifford R. Richey. Nov. 12, 1958. 10p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

A method for determining the epithermal ratio for various reactors is presented. As background for development of such a method, a digest of the British and Canadian formulation is given. To check the validity of the epithermal ratio formulation, cadmium ratios computed from epithermal ratios were compared with values measured in the exponential piles. (W.D.M.)

5655 KAPL-M-RM-2
Knolls Atomic Power Lab., Schenectady, N. Y.
A STUDY OF THE WORTH OF PARTIALLY INSERTED CENTRAL CONTROL RODS. C. Raymond Mullin. Jan. 5, 1959. 8p. Contract W-31-109-Eng-52. $1.80 (ph OTS); $1.80(mf OTS).

A technique is described for estimating the fractional worth of a central rod, or gang of rods as they are inserted into a homogeneous reactor. (auth)

5656 LA-2256
Los Alamos Scientific Lab., N. Mex.
NUMERICAL STUDY OF THE MOTIONS OF VARIOUSLY-SHAPED SLABS ACCELERATED BY A HOT GAS. Francis H. Harlow and Donald O. Dickman. Sept. 1958. 40p. Contract W-7405-eng-36. $1.25(OTS).

Numerical computations were performed to determine the motion of a two-dimensional slab of initially-cold gas accelerated by a hot gas. The cold-gas slab had a sequence of holes, flanges, or other perturbations to its otherwise straight, parallel, infinite bounding walls. Information is presented regarding pertinent characteristics of the computing method. (auth)

5657 LMSD-5065
Lockheed Aircraft Corp. Missile Systems Div., Sunnyvale, Calif.
RADIOACTIVATION OF OXYGEN AND CARBON IN BERYLLIUM. D. B. Beard, R. G. Johnson, and W. G. Bradshaw. Aug. 20, 1958. 22p. Contract NOrd-17017.

An activation technique is described for determining the presence of carbon and oxygen contaminants in beryllium and for identifying these impurities with a maximum sensitivity of several parts per million. (auth)

5658 MURA-440
Midwestern Universities Research Assn., Madison, Wis.
ON HELMHOLTZ'S THEOREM IN FINITE REGIONS. J. Van Bladel. Dec. 29, 1958. 32p. Contract AT(11-1)-384. $1.00(OTS).

The splitting of a continuous vector function into a gradient plus a curl is possible in an infinite number of ways. Two particular uniquely determined splittings called electric and magnetic are dealt with. Eigenvector expansions suitable for these splittings are examined, and the application of these expansions to the calculation of the various terms of the splitting is considered. (auth)

5659 NASA-Memo-1-20-59L
National Aeronautics and Space Administration. Langley Research Center, Langley Field, Va.
MEASUREMENTS OF TOTAL HEMISPHERICAL EMISSIVITY OF SEVERAL STABLY OXIDIZED METALS AND SOME REFRACTORY OXIDE COATINGS. William R. Wade. Jan. 1959. 30p.

A description of the apparatus and methods used for obtaining total hemispherical emissivity is presented, and data for several stably oxidized metals are included. The metals which were tested included type 347 stainless steel, tungsten, and Haynes alloys B, C, X, and 25. No values of emissivity were obtained for tungsten or Haynes alloy B because of the nature of the oxides produced. The refractory oxide coatings tested were flame-sprayed alumina and zirconia. The results of the investigation indicate that strongly adherent, oxidized surfaces of a high stable emissivity can be produced on type 347 stainless steel for which the total hemispherical emissivity varied from 0.87 to 0.91 for temperatures from 600 to 2,000°F. For this same temperature range, the Haynes alloys tested showed values of total hemispherical emissivity from 0.90 to 0.96 for alloy C, from 0.85 to 0.88 for alloy X, and from 0.85 to 0.89 for alloy 25. Haynes alloy B and tungsten formed nonadherent oxides at elevated temperatures and, therefore, stable emissivities were not obtained. The results obtained for the flame-sprayed ceramics showed considerably higher values of total emissivity than those measured for coatings applied by other methods. Emissivity values ranging from 0.69 to 0.44 for aluminum oxide and from 0.62 to 0.44 for zirconium oxide were measured for temperatures from 800 to 2,000°F. (auth)

5660 NBS-6149
National Bureau of Standards, Washington, D. C.
CRYSTAL SPECTROMETER CALIBRATION OF HIGH ENERGY X-RAY INTENSITY MONITORS. J. E. Leiss, J. S. Pruitt, and R. A. Schrack. Sept. 1958. 34p. NBS Project 0411-11-3151. $6.30(ph OTS); $3.00(mf OTS).

A technique is described for the calibration of high-energy x-ray monitors by counting the total number of photons transmitted in good geometry by long absorbers. The application of this technique to the calibration of two specific ionization chambers in the energy region 20 to 180 Mev is discussed. Good agreement with calorimetric calibrations of these chambers is found. (auth)

5661 NP-7107
Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
QUARTERLY PROGRESS REPORT NO. 51 FOR PERIOD ENDING OCTOBER 15, 1958. J. B. Wiesner, G. G. Harvey, and H. J. Zimmermann. 135p. Project No. 3-99-00-100. Contract DA36-039-sc-64637.

Physical Electronics. By means of ZnS probe crystals the electric conductivity of ZnS crystals was investigated. Experiments to correlate changes in surface-trap density of Ge and changes in contact potential are described. Data previously reported on the characteristics of semiconductor junctions is analyzed. A transistorized low-voltage regulated power supply has been developed. Microwave Gaseous Discharges. Some results from measurements of noise in d-c helium discharges over a large range of parameters are given and discussed. Some of the properties of a particular microwave cavity used for containment of charged particles are discussed. The apparatus used and the experiments performed in a study of the interaction of a plasma beam with a magnetic field are described. The effect of the plasma on the impedance of a coil loaded with a coaxial plasma is shown, taking account of ions

and proper boundary conditions at the edge of the plasma. Plasma Dynamics. The dynamics of wave propagation in a hydromagnetic waveguide were studied. Expressions for relating the upstream parameters of a magnetohydrodynamic shock to its downstream parameters are discussed, and construction and instrumentation of a T tube for magnetically driven shocks are described which will be used to verify the discussion. Solid State Physics. The 3 adiabatic elastic constants of NaI were measured at 170 to 300°K by an ultrasonic pulse-echo technique. A study of the recombination of electrons with donors is extended. Microwave Spectroscopy. Ruby with 0.01% Cr^{3+} impurity was used as a paramagnetic crystal in an attempt to excite and detect lattice phonons. Experiments were performed in an attempt to detect phonon-spin absorption in F-center quartz and in potassium chromicyanide. Operation of a tunable ruby maser with large bandwidth is described. Reports are given from studies of antiferromagnetic resonance in $MnCl_2$, paramagnetic resonance in ruby, and dependence of spin-lattice relaxation time of F^{19} in LiF crystals upon the concentration of radiation-induced F-centers. Nuclear Magnetic Resonance and Hyperfine Structure. The hyperfine structure and isotope shifts of Tl^{199} and Tl^{200} were studied spectroscopically. The relation between the g-factors and lifetimes of the excited states of two-electron atoms such as Zn, Cd, or Hg was studied. A high-resolution dispersion and intensity spectrograph is described. The Hall effect in the plasma of a lamp containing Hg vapor in Ar was investigated. Microwave Electronics. A perturbation formula for ferrite-filled cavities is given. A theorem is devised for the small-signal excitation in an electromagnetic system that contains an electron beam or an electron space charge cloud with zero curl of the generalized momentum. Klystron gap theory is further developed by evaluating the gap matrix elements. Atomic Beams. Progress in construction of the apparatus for measuring the velocity of light is reported. Frequency Modulation. The results of a study of the locking and interference suppression characteristics of an oscillating limiter are summarized. The construction and testing of a receiver capable of capturing the weaker of two cochannel FM signals is reported. Statistical Communication Theory. Experiments with a digital probability density analyzer are described in which the second-order probability density of a random process generated by passing the noise output of a gas triode through a narrow-band filter was measured. Stroboscopic Research. Development and use of strobe flash lights for deep sea photography is discussed. Statistical Thermodynamics. Further study of the λ-line of liquid helium is reported. Progress is also reported for studies in Physical Acoustics, Speech Communication, Communications Biophysics, Network Synthesis, and Circuit Theory. (For preceding period see NP-7003.) (T.R.H.)

5662 NP-7123
Brussels. Centre d'Étude de l'Énergie Nucléaire. CODE 01. (In French). J. Van Der Parren. Apr. 16, 1958. 51p.

An adaptation to the IBM 650 of a two-group theory developed on NDA is described. The code permits a criticality calculation, either followed or not followed by flux and current calculations. One can easily calculate the effect of modifications on one region only by assuming constant boundary conditions. The code allows the calculations of adjacent fluxes by the introduction of two supplementary steps. A maximum of 8 regions and 53 intervals can be treated. (tr-auth)

5663 NP-7128
Brussels. Centre d'Étude de l'Énergie Nucléaire. CODE 05. (In French). R. De Meersman. July 29, 1958. 97p.

An adaptation of a criticality test based on the two-group theory to the IBM-650 is described. The code is written in machine language and is divided into three parts. The criticality calculation can either be followed or not by the calculation of the flux and currents. A maximum of 30 regions and 107 intervals can be considered. The Gill-Kutta method is used for the numerical integration. (J.S.R.)

5664 NP-7142
Brussels. Centre d'Etude de l'Energie Nucléaire. QUELQUES OBSERVATIONS SUR LE DEVELOPPEMENT DES EMULSIONS K5, 600 MICRONS DU STACK K2, IRRADIE A BERKELEY, POUR L'ETUDE DES PARTICULES MESONIQUES. (Some Observations on the Development of K5 Emulsions, 600 Microns of the K2 Stack, Irradiated at Berkeley for the Study of Meson Particles.) R. Sour. Feb. 26, 1958. 5p.

The procedure used in the development of a stack of K5 emulsion films after exposure at the Berkeley cyclotron is described in detail. The conditions for rolling, drying, impregnation, preparation of the developer and fixer, and fixing are given. (J.S.R.)

5665 NP-7145
Brussels. Centre d'Etude de l'Energie Nucléaire. EMPLOI DES EMULSIONS NUCLEAIRES CHARGEES AU BORE POUR LA DETERMINATION DE LA DENSITE EN NEUTRONS THERMIQUES. ETUDE DES CHARGES REDUITES. (Use of Nuclear Emulsions Charged with Boron for the Determination of the Thermal Neutron Density. Study of Small Charges.) J. Vandermeulen. Aug. 1, 1958. 30p.

A study was made of the precision of the nuclear emulsion technique for the determination of thermal neutron density and of methods to improve the precision. A strong effect of the thickness of the developed emulsion on the number of tracks was observed. The hypothesis of the linear dependence of the number of tracks with respect to the thickness was justified as a first approximation. Uniformity is attained to the same degree in all lots of plates studied regardless of the loading. The discrimination between interior tracks and secant tracks was improved by the use of the etching analytical technique instead of the microscopic technique. There was a variation between the amount of boron said to be in the plates and the amount actually found. A possible surface effect on the distribution of boron nuclei at the interior of the emulsion was observed. (J.S.R.)

5666 NP-7150
Brussels. Centre d'Étude de l'Énergie Nucléaire. LA MESURE DE LA RETOMBEE RADIOACTIVE AU C.E.N. RAPPORT TRIMESTRIEL D'AVANCEMENT. (Radiations Control. Measurement of the Radioactive Fall-out at the C.E.N. Tri-monthly Progress Report.) E. Vander Stricht. Aug. 20, 1958. 7p.

A survey of the methods used at the C.E.N. for the determination of radioactive fall-out is presented. Results obtained on the determination of Sr^{90} in milk from cows pastured adjacent to the site are given. The radioactivity of rain water recorded by the U.S.A., U.K., and U.S.S.R. through August of 1958 is graphed. (J.S.R.)

5667 NP-7151
Brussels. Centre d'Etude de l'Energie Nucléaire.
BETA ENERGIEBEPALING MET EEN ANTHRACENE KRISTAL EN MET DE FEATHER METHODE. (Beta Energy Determination with an Anthracene Crystal and with the Feather Method.) H. Depuydt. Feb. 25, 1958. 27p.

The beta spectra of Au^{198}, In^{114}, P^{32}, Y^{90}, and Cs^{137} were determined with a scintillation counter (anthracene crystal) and an amplitude selector. The conversion electron peak of Cs^{137} was used for the determination of the pulse-height energy calibration line. The maximum beta energy was determined by means of a Fermi-Curie analysis of the spectra, and the results were 0.928 ± 0.05 Mev for Au^{198}, 2.10 ± 0.02 Mev for In^{114}, 1.703 ± 0.018 Mev for P^{32}, 2.42 ± 0.02 Mev for Y^{90}, and 0.522 ± 0.010 and 1.28 ± 0.31 Mev for Cs^{137}. The maximum beta energy determination was made by means of the absorption curve to which the Feather analysis was applied (the absorption curve of P^{32} serving as a standard). The results were 0.947 Mev for Au^{198} and 2.02 Mev for In^{114}. (tr-auth)

5668 NP-7153
Brussels. Centre d'Étude de l'Énergie Nucléaire.
ANALYSE DE L'HOMOGENEITE D'UN DEPOT D'URANIUM SUR ALUMINIUM. (Analysis of the Homogeneity of a Uranium Deposit on Aluminum.) J. Fournaux. Feb. 21, 1958. 7p.

The homogeneity of uranium deposited on aluminum electrolytically and by painting was studied by means of emulsions sensitive to alpha particles. The measurement is based on the fact that the distribution of alpha particles emitted during a given time by a unit surface will follow a Poisson curve. A statistical study of the index of dispersion shows if the distribution follows a Poisson curve. The homogeneity of the electrolytic deposit was verified, but not that of the painted deposit. (J.S.R.)

5669 NP-7154
Brussels. Centre d'Etude de l'Energie Nucléaire.
ONDERZOEK NAAR HET GEDRAG VAN DISLOKATIES IN IONENKRISTALLEN BIJ NEUTRONENBESTRALING. (Investigation of the Behavior of Dislocalities in Ion Crystals During Neutron Irradiation.) J. Schepers. June 20, 1958. 16p.

A series of experiments was made to determine if dislocations occur during neutron irradiation of ionic crystals or if existing dislocations are moved. The possible mechanism of the formation and the cause for the movement of existing dislocations are discussed. The dislocation-etch pattern relationship was considered, and the experimental techniques were described. In the first series of experiments with LiF crystals, no transfer or initiation of dislocations was observed at an integrated neutron flux of 8×10^{17} neutrons/cm^2 and a reactor temperature between 80 and 100°C. (J.S.R.)

5670 NP-7156
Brussels. Centre d'Étude de l'Énergie Nucléaire.
BR-1. CALCUL DE L'ENERGIE ACCUMULEE DANS LE GRAPHITE PAR EFFET WIGNER. (BR-1. Calculation of the Energy Accumulated in the Graphite by the Wigner Effect.) G. Penelle. Sept. 4, 1958. 16p.

A method for calculating Wigner energy is proposed. The method was applied to the graphite of the central lattice and to some points of the structure of the BR-1. An estimate of the energy at different dates was made. The time for the first annealing was deduced. (tr-auth)

5671 NP-7165
Brussels. Centre d'Étude de l'Énergie Nucléaire.
GEDRAG VAN DICHTHEID EN ROOSTERPARAMETER VAN MET NEUTRONEN BESTRAALD LiF. (Effect of Density and Lattice Parameter of LiF Irradiated with Neutrons.) J. Spaepen. Aug. 4, 1958. 10p.

A series of experiments was conducted on LiF crystals to determine the effects of neutron irradiation on the density and lattice parameters. Preliminary results show that the effect on the density depends on the crystal thickness even for thin crystals. After the maximum in the lattice parameter-dose curve is passed, the density decreases differently from the lattice parameters. Small density decreases exist even after restoration at 650°C. (J.S.R.)

5672 NP-7167
Brussels. Centre d'Étude de l'Énergie Nucléaire.
STUDIE VAN DE HERSTELTRAPPEN DER RESISTIVITEIT IN MET NEUTRONEN BESTRAALDE HOOGSMELTPUNT-METALEN. DRIEMAANDELIJKS VORDERINGSVERSLAG. (Study of The Restoration Steps of the Resistivity of High Melting-Point Metals Irradiated with Neutrons. Tri-Monthly Progress Report.) J. Nihoul. June 16, 1958. 18p.

The restoration of electrical resistivity after neutron irradiation was studied in molybdenum, tungsten, and niobium. The experimental techniques and the preparation of the samples are described. The relative resistance increase after irradiation was measured at the temperature of liquid nitrogen, and the results are tabulated. (J.S.R.)

5673 NP-7179
New York Univ. New York.
RESEARCH ON SOLID STATE RADIATION-INDUCED PHENOMENA. Quarterly Progress Report No. 2 [for] July, August, September [1958]. Hartmut Kallman. Nov. 1958. 48p. Contract DA 36-039 SC-75043.

Part I. Methods found successful in increasing the efficiency and extending the application of liquid scintillators are applied to scintillators prepared in polystyrene and in polymethylmethacrylate. It is found that concentration quenching does not occur in either and that the intermediate "solvent" method enhances energy transfer and overcomes quenching caused by the incorporation of specific impurities in both plastics. Efficient scintillators are prepared in both plastics. The best polystyrene scintillator prepared has a fluorescence efficiency approximately equal to that of the best liquid scintillators; the best polymethylmethacrylate scintillator has a fluorescence efficiency approximately 60% that of the best liquid scintillators. Part II. The conductivity and light emission of three ZnS phosphors are investigated at room and low (liquid nitrogen) temperature. The ZnS phosphor that is copper activated shows a marked decrease (by a factor of at least 100) in conductivity at liquid air temperature while the light emission decreases by a factor of 2. The rise time of the conductivity is about the same at liquid air as at room temperature. For the two ZnS phosphors that are silver activated, the conductivity does not change appreciably between room and liquid air temperature. The fluorescence increases at the lower temperature by a factor of 2 or 3 depending on the phosphor. The rise times are appreciably longer at low temperature than at room temperature. Part III. Measurements are reported on ZnS phosphors at liquid nitrogen temperature which compare the light emitted during a "glow

curve" (G) with the deficiency area during the rise curve (D). For three different phosphors (Ag, Cu, or Mn as activators) the ratio $G/D \geq 1$ for every case but one. For all 3 phosphors this ratio is greater when the excitation is band to band (short u.v. or β-rays) than with activator excitation. The fluorescent light emission is lower at room temperature than liquid nitrogen temperature for the Ag activated phosphor but the reverse is true for Cu or Mn activation. A short theoretical discussion is included in which the value of G/D is obtained from the kinetics of electron transitions, and, under certain conditions, it is shown that this ratio is the reciprocal of the phosphor efficiency. (For preceding period see NP-6874.) (auth)

5674 NP-7180
Buffalo. Univ.
PROGRESS REPORT NO. 5 [FOR] OCTOBER 1, 1958 TO DECEMBER 31, 1958. J. F. Andrew, J. Okada, J. Repetski, H. E. Strauss, D. C. Wobschall, and S. Mrozowski. Jan. 2, 1959. 18p. Contract AF33 (616)-5186.

The modulus of ridigity G and Young's modulus E for ½-in.-diam. calcined coke rods were measured at room temperature after heat treatment to various temperatures. The elastic moduli of carbons made from soft filler–soft binder and soft filler–hard binder were measured at room temperature as a function of heat treatment from 500 to 1700°C. A series of thermal conductivity measurements was made on carbon rods through the range 1000 to 2800°C. Equations are presented for determining thermal diffusivity of various carbons. (For preceding period see NP-6998.) (W.L.H.)

5675 NP-7183
Duke Univ., Durham, N. C.
DUKE MICROWAVE LABORATORY REPORT NO. 23 [FOR] AUGUST 1, 1958–NOVEMBER 1, 1958. 59p. Project No. R-357-10-6. Contract AF18(600)-497.

With this are bound: ELECTRON SPIN RESONANCE STUDIES OF IRRADIATED TEFLON: EFFECTS OF VARIOUS GASES. Harvey N. Rexroad and Walter Gordy. (AFOSR-TN-58-870; AD-203715). ELECTRON SPIN RESONANCE IN AN IRRADIATED SINGLE CRYSTAL OF DIMETHYLGLYOXIME. Ichiro Miyagawa and Walter Gordy. (AFOSR-TN-58-1034; AD-206484). CYCLOTRON RESONANCE IN FLAMES. Jürgen Schneider and F. W. Hofmann. (AFOSR-TN-58-1035; AD-206481).

The radical produced by x or γ radiation on Teflon in high vacuum is shown to have 5 F atoms with nuclear coupling to the electron spin, four with equivalent coupling of 33 gauss, and one with 92 gauss. The effects of O_2, CO, H_2, and NO on the resonance were studied. The paramagnetic resonance of irradiated single crystals of dimethyl glyoxime at 23 kMc/sec and 9 kMc/sec for various orientations showed a triplet structure caused by coupling to a single N^{14}. The free radical produced is probably the ionized dimethylglyoxime molecule. A brief account of work on cyclotron resonance in low-pressure flames near 24 kMc/sec is given. (See also NP-6973.) (T.R.H.)

5676 NP-7188
Saint Louis Univ.
NEUTRON DIFFRACTION STUDY OF THE STRUCTURE OF GLASSES. PART I. ELASTIC AND INELASTIC SLOW NEUTRON SCATTERING BY THE EINSTEIN MODEL. Final Technical Report [for] November 1, 1952 through October 31, 1958. R. M. Delaney and A. H. Weber. Nov. 15, 1958. 28p. Contracts DA-23-072-ORD-473; DA-23-072-ORD-593.

The effect of binding on atoms in a crystal lattice is considered in relation to the determination of neutron cross sections. The energies involved are usually insufficient to excite the nucleus itself to higher energy levels, in which case the nucleus could be treated as a single particle for thermal neutrons. The calculations of Finkelstein (Phys. Rev. 72, 907(1947)) are extended, and it is shown that the Einstein model has a greater range of applicability to neutron scattering than previously thought. All possible transitions are summed, thus allowing application of any Einstein model and any substance temperature. It was concluded that computations using Einstein cross sections may be made for high sample temperatures and high neutron energies which can be expected to be in good agreement with observation, while the same calculation can be made only with great difficulty using Debye cross sections. (J.R.D.)

5677 NP-7196
Colorado. Univ., Boulder.
RESEARCH AND DEVELOPMENT IN CONNECTION WITH HIGH ALTITUDE CLOUD CHAMBER STUDY OF COSMIC RAY NUCLEAR INTERACTIONS. Final Report [for] January 1, 1956–December 31, 1958. Albert B. Weaver. 20p. DA Project No. 5B99-01-004. Contract DA-23-072-ORD-956.

The design and construction of cloud chambers for high-altitude cosmic-ray studies are described. The arrangement includes 3 stacked chambers and associated counters, circuits, oscillographs, and cameras. (T.R.H.)

5678 NP-7226
Stanford Research Inst. Poulter Labs., Menlo Park, Calif.
TUBE COLLAPSING CHARGE. Technical Report 019-58. Thomas C. Poulter and Milton C. Kells. Apr. 14, 1958. 7p.

There are many occasions in high-explosive, hydrodynamic studies when it is desirable to use an extremely rapid shuttering device for protecting instrumentation and surfaces from high-velocity fragments. A satisfactory charge has been developed for a 4-in. steel tube of ¼-in. wall thickness when the tube is surrounded by water. The closing time is 112 μsec. (W.D.M.)

5679 NP-7235
Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.
ANGULAR DISTRIBUTION OF HIGH-ENERGY BREMSSTRAHLUNG. Report No. 49/VII. A. Deloff and R. Gajewski. Dec. 1958. 7p.

The angular and energy distributions of Bremsstrahlung quanta for large angles and at the high energy peak of the spectrum are discussed. (J.R.D.)

5680 NP-7236
Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.
MUON DEPOLARIZATION IN HIGH ENERGY MUON-ELECTRON SCATTERING. Report No. 50/VII. A. Deloff and R. Gajewski. Dec. 1958. 8p.

The polarization change of high-energy muons due to their collision with electrons was calculated. The results obtained were then used to estimate the depolarization contribution originating from muon-electron scattering to the total depolarization occurring when muons pass a layer of matter. An inference was drawn

that the contribution to muon depolarization arising from collisions with atomic electrons is Z times smaller than the depolarization caused by Coulomb scattering. (J.R.D.)

5681 NYO-2149
Yale Univ., New Haven.
NATURAL LINE WIDTH FOR TRANSIENT EXCITATIONS. G. Breit and M. H. Hull, Jr. Sept. 30, 1958. 29p. Contract AT(30-1)-1807. $4.80(ph OTS); $2.70 (mf OTS).

The absorption of a photon by a material system with 4 participating levels A, B, C, and D is studied with special attention to the case in which the levels are the result of combining excitations of separate systems from a → a′ and from b → b′ with the identification of A, B, C, and D with (a,b), (a,b′), (a′,b), and (a′,b′), respectively. The absorption width of the HD transition is shown to approach the limit expected for the decoupled system as the parameters corresponding to the decoupled condition are made to approach their special values. It is similarly shown how the formulas for rescattering by the general system approach those for the decoupled system. It is found that the procedure of folding the radiation widths of upper and lower levels in a radiation transition in order to obtain the width of an absorption or emission line has to be used with care, the circumstances entering the excitation of the levels needing consideration. Correlations in photon magnitudes in double photon emission and absorption enter some of the considerations. The consideration of the double photon emission solution is used as an illustration of the role of the ratio of the strength of coupling between electrons to the natural line width. (auth)

5682 SCR-63
Sandia Corp., Albuquerque, N. Mex.
ON THE RADIAL EIGENFUNCTIONS AND ASYMPTOTIC PHASE SHIFTS OF ELECTRONS SCATTERED BY HARTREE POTENTIALS. W. J. Byatt and F. O. Lane, Jr. Jan. 1959. 16p. Contract AT(29-1)-789. $0.50 (OTS).

Radial eigenfunctions and asymptotic phase shifts for electrons elastically scattered by the Hartree potentials of He, N, O, Ar, and Kr were found. An analog computer with the Hartree potential inserted by a function generator of accuracy of the order of better than 2 percent was used in the work. The potential function generator can be blanked out so that a free particle solution (spherical Bessel function) can be directly compared with the eigenfunction resulting from the inclusion of the potential. This has the advantage that the phase shift can be read directly from the plots. Results of the calculations are presented, and, where possible, a comparison with previous published results is made; the over-all accuracy is discussed. The energy domain considered is nonrelativistic. (auth)

5683 SCTM-381-58(51)
Sandia Corp., Albuquerque, N. Mex.
A CONFIDENCE REGION FOR THE DISTRIBUTION OF BINOMIAL PROBABILITIES. L. H. Koopmans. Jan. 8, 1959. 18p. Contract AT(29-1)-789. $3.30(ph OTS); $2.40(mf OTS).

The beta distribution is assumed to govern the selection of M unobservable probabilities p_k (k = 1, 2, ..., M). M binomial experiments of n trials each are performed with the probability of a success on any trial on the k^{th} experiment being p_k. From the observed results of these experiments, a 100 γ-percent confidence region is derived for the parameter of the underlying beta distribution using a normal approximation. An example is included which applies the model to lot acceptance sampling by attributes. (auth)

5684 SCTM-428-58(51)
Sandia Corp., Albuquerque, N. Mex.
LONGITUDINAL STABILITY OF A BODY OF REVOLUTION WITH FLOATING FINS AND TABS (thesis). James Iversen. Jan. 8, 1959. 38p. Contract AT(29-1)-789. $6.30(ph OTS); $3.00(mf OTS).

Submitted to Iowa State Coll.

An experimental study was made to determine the effect of floating fins of various configurations on the longitudinal dynamic stability of an aerodynamic shape. Five fin configurations were tested at subsonic velocities. The constrained fin and geared fin configurations showed the most promise toward an increase in stability without an increase in fin size. (auth)

5685 UCRL-5293
California. Univ., Livermore. Lawrence Radiation Lab.
ZOOM—A ONE-DIMENSIONAL, MULTIGROUP, NEUTRON DIFFUSION THEORY REACTOR CODE FOR THE IBM 704. R. N. Stuart, E. H. Canfield, E. E. Dougherty, and S. P. Stone. Nov. 19, 1958. 54p. Contract W-7405-eng-48. $9.30(ph OTS); $3.60(mf OTS).

ZOOM is an IBM-704 Code which solves the one-dimensional multigroup neutron diffusion equation for spheres, cylinders, and slabs. The diffusion equation is approximated by a set of difference equations which are solved (using the back-substitution technique) by iterating on the power. The output includes: spatial power distribution, effective multiplicative factor, spatial and energy distributions of flux, and listings of all input data. Important features of the code include: capacity to handle up to 80 energy groups, 10 materials, and 30 spatial mesh points; high-order differencing of the differential equations, thus allowing a high degree of accuracy to be obtained with relatively few mesh points; transfers of neutrons between all energy groups (allowing treatment of inelastic and thermal processes); a "purification" technique which eliminates undesirable eigenmodes, speeding up the convergence process; energy-dependent extrapolation length boundary conditions; dependence of the fission spectrum upon the energy of the neutron causing fission; and ability to handle asymmetric slabs. (auth)

5686 UCRL-8430
California. Univ., Berkeley. Lawrence Radiation Lab.
YIELD AND RANGE STUDIES OF SELECTED FISSION PRODUCTS FROM URANIUM BOMBARDED WITH BEV PROTONS. Christiane Baltzinger. [Aug. 1958]. 30p. Contract W-7405-eng-48. $6.30(ph OTS); $3.00(mf OTS).

In order to obtain information about the mechanism of the breakup of the uranium nucleus at high bombarding energies, uranium foils were bombarded with 0.72 and 6.2 Bev protons. The formation cross sections and the ranges of Cu^{67}, Mo^{99}, and Ag^{111} were determined by radiochemical means. The yields of several isotopes of molybdenum were investigated to determine the influence of the neutron-to-proton ratio on the reaction probability. The cross sections follow the general trend indicated by previous work of different authors. The kinetic energy of each of these products indicates that fission is a major process for the formation of these nuclides. The average velocity imparted to the struck

nuclei giving rise to the specific products has been calculated. Ranges and imparted velocity decrease as the bombarding energy increases. (auth)

5687 UCRL-8554
California. Univ., Berkeley. Lawrence Radiation Lab.
RELOCATABLE SOAP-II SUBROUTINE FOR FINDING CLEBSCH-GORDAN COEFFICIENTS. Marjory C. Simmons. Nov. 25, 1958. 5p. Contract W-7405-eng-48. $0.50(OTS).

An outline of the nature and use of a subroutine for computing Clebsch-Gordan coefficients has been written for the IBM-650 Augmented Data Processing System. Some familiarity with IBM's Symbolic Optimal Assembly Program (SOAP) is assumed. (auth)

5688 UTIA-REV-9
Toronto. Univ. Inst. of Aerophysics.
AN INTRODUCTION TO THE EQUATIONS OF MAGNETOGASDYNAMICS. J. A. Steketee. Apr. 1957. 41p.

A review, in two parts, of magnetohydrodynamics and magnetogasdynamics is presented. In part A a short discussion of Maxwell's equations in isotropic media at rest is given while the modifications are indicated which have to be made if the media are in motion. In part B the equations of Maxwell and the hydrodynamic equations are combined to obtain the usual equations of magnetohydrodynamics. The discussion finishes where the ordinary research report begins. (auth)

5689 WADC-TN-58-348
Aerojet-General Corp., Azusa, Calif.
EXPERIMENTS ON POROUS-WALL COOLING AND FLOW-SEPARATION CONTROL IN A SUPERSONIC NOZZLE. L. Green, Jr. and K. L. Nall. Dec. 1958. 138p. Project No. 3151. Contract AF33(616)-5552. (AGC-1490).

Control of flow separation by fluid injection at one diverging boundary of a two-dimensional, transparent-walled de Laval nozzle was investigated by spark schlieren photography of dry-nitrogen flows expanded from two stagnation temperatures (500 and 990°F) and four stagnation pressure levels (250, 300, 350, and 400 psig). Injection conditions at the permeable boundary were varied by the use of three grades of porous stainless steel with nominal mean pore diameters of 10, 20, and 30 microns. In addition to the case of no pressurized injection, nitrogen was forced through the steel by coolant reservoir pressures of 25, 50, and 100 psig. Pressure distribution measurements were made along the nonpermeable diverging boundary. It was found that flow separation at expansion ratios approaching the optimum value for maximum thrust coefficient could be inducted at the porous wall by a local injection mass velocity of the order of a few percent of the local mainstream mass velocity. Separation at the solid boundary was not noticeably influenced by injection at the opposite wall, and the asymmetrical separation thus effected jet deflections of up to 10° at the lower stagnation-pressure levels. Variation of the wall heat-transfer condition by using increased stagnation temperatures (for comparison with previous cold-flow experiments) did not significantly influence separation behavior. Temperature measurements at the reservoir-face of the porous section, together with use of the Rubesin analysis for estimation of stream-face Stanton numbers under injection conditions, permitted heat-transfer calculations which demonstrated the high effectiveness of the transpiration technique in controlling nozzle-wall temperatures. 207 references. (auth)

5690 WAPD-S5W-R-2112
[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]
SAMPLE ATBAC PROBLEM. J. M. Weaver. Nov. 9, 1957. 15p. $3.30(ph OTS); $2.40(mf OTS).

The basic parameters, heat flux distributions, etc., for a fictitious reactor are developed into ATBAC input. The actual results of an ATBAC run using the data are presented. (W.L.H.)

5691 WAPD-TM-137
Westinghouse Electric Corp., Bettis Plant, Pittsburgh.
DRACO—A THREE-DIMENSIONAL FEW-GROUP DEPLETION CODE FOR THE IBM-704. D. S. McCarty, C. M. King, J. T. Mandel, and H. P. Henderson. Dec. 1958. 71p. Contract AT-11-1-GEN-14. $2.00(OTS).

A three-dimensional few-group depletion code programmed for the IBM-704 is presented. The code, called DRACO, is used in studying the neutron flux, the power level, and the related buildup and depletion of materials at different stages in a reactor lifetime. The three sections of the code are described, and the background documents are referenced. (auth)

5692 WAPD-TM-164
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
NEUTRON BURSTS IN A RING REACTOR. D. R. Harris. Oct. 1958. 14p. Contract AT-11-1-GEN-14. $0.50(OTS).

Azimuthal propagation of disturbances in a large annular reactor is investigated by studying the equalization of neutron bursts in a ring or simply-periodic reactor. One-velocity diffusion theory is employed to obtain convenient expressions for the time required for approximate equalization of neutron density around the ring. (auth)

5693 AEC-tr-3542
IMPULSE HIGH FREQUENCY ION SOURCE. G. S. Malkiel and B. I. Suhanov. Translated by A. L. Monks (Oak Ridge National Lab.) from Pribory i Tekh. Ekspt., No. 3, 100-101(1958). 4p. $1.80(ph); $1.80(mf) JCL or LC.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 1329.

5694 AEC-tr-3545
BENDING OF JOIST AGGREGATES. (Über die Biegung von Trägerrosten.) S. Timoshenko. Translated for Oak Ridge National Lab. from Z. Angew. Math. u. Mech. 13, 153-9(1933). 14p. $4.80(ph); $2.70(mf) JCL or LC.

An approximation solution is presented, which is obtained by the use of trigonometric series for the elastic lines of the joists for the case of a joist aggregate consisting of several identical joists which have been distributed at equal distances from each other and which are supported by one or several girders. The approximation formulas obtained in this manner for the greatest deflection of the girders are very simple and can be utilized to advantage in practical calculations. (auth)

5695 AEC-tr-3546
ELECTRON PARAMAGNETIC RESONANCE IN ALLOYS OF ALKALI METALS. N. S. Garifyanov and M. A. Starikov. Translated by R. A. Hultsch (Ames Lab.) from Zhur. Eksptl'. i Teoret. Fiz. 35, 798(1958). 4p. $1.80(ph); $1.80(mf) JCL or LC.

The resonance absorption in alloys of sodium and its dependence on the concentration of the composite, using

as constituents Li, Hg, Pb, K, and Wood's metal, was studied. The frequency used was 290 Mcps at temperatures of 90 and 300°K. In addition, the paramagnetic resonance in alloys of lithium, using as constituents Na, K, Hg, Pb, and Wood's metal, was investigated. The metals Na and K had little effect on the paramagnetic resonance when alloyed with lithium. This is also true in the case of sodium. The quantitative results for these alloys do not lead to any conclusions since the lithium used had a purity of 98%, and, moreover, lithium forms very poor alloys with Na and K. (J.R.D.)

5696 AEC-tr-3547
SHIFT OF THE NUCLEAR MAGNETIC RESONANCE IN MOLYBDENUM. S. I. Aksenov. Translated by R. A. Hultsch (Ames Lab.) from Zhur. Eksptl'. i Teoret Fiz. 35, 300(1958). 3p. $1.80(ph); $1.80(mf) JCL or LC.

The shift of the nuclear magnetic resonance in molybdenum metal caused by the paramagnetism of the conduction electrons (Knight shift) was studied. The resonance determinations were made using especially prepared molybdenum powder. The Knight shift was measured with respect to the resonances of Mo^{95} and Mo^{97} in an aqueous solution of K_2MoO_4 and thus depends on the value of the chemical shift in this compound. (J.R.D.)

5697 AEC-tr-3549
ON THE QUENCHING OF LUMINESCENCE OF ORGANIC SUBSTANCES UPON EXCITATION BY α-PARTICLES. M. D. Galanin and Z. A. Chizhikova. Translated by Lydia Venters (Argonne National Lab.) from Optika i Spektroskopiya 4, 196-202(1958). 8p. $1.80(ph); $1.80(mf) JCL or LC.

The ratio of luminescence yields upon excitation by α particles of Po^{210} and γ rays of Co^{60} for organic crystals, plastic scintillators, and solutions has been measured. This ratio is identical in all cases and is equal to 0.10 ± 0.01. In order to determine which type of quenching process takes place upon excitation, the quenching of α and γ luminescence of terphenyl in xylene by carbon tetrachloride was investigated. It was shown that a low yield in α excitation is chiefly determined by the quenching of the first type, i.e., the quenching occurs over a period of time which is short as compared to the duration of the excited state. (auth)

5698 AEC-tr-3554
IONIC CONDUCTION AND DISORDER OF SILVER CHLORIDE WITH ADDITIONS. (Zur Ionenleitung und Fehlordnung von Silberchlorid mit Zusätzen.) Ines Ebert and J. Teltow. Translated for Atomics International from Ann. Physik (6), 15, 268-78(1955). 24p. (Includes original, 11p.) $4.80(ph); $2.70(mf) JCL or LC.

The electric conductivity of AgCl with additions of $CdCl_2$, $PbCl_2$, CuCl, and Ag_2S is measured between 200°C and the melting point in the mixed crystal region. From the measurements the defect concentrations are derived, and conclusions are drawn on the interaction of the defects and the energy quantities. An anomaly of the conductivity of the pure salt is discussed. (auth)

5699 APEX-436
ON THE INTEGRATION OF A SYSTEM OF DIFFERENTIAL EQUATIONS. M. M. Smirnov. Translated by J. F. Heyda (General Electric Co., Cincinnati) from Priklad. Mat. i Mekhan. 19, 217-18(1955). 6p. (XDC-58-10-106). $1.80(ph); $1.80(mf) JCL or LC.

The system of equations describing the temperature distributions in the two fluids flowing in a cross-flow heat exchanger, with appropriate boundary conditions, is solved in closed form. (auth)

5700 SCL-T-216
THE PHENOMENON OF PERSISTENCE AND ITS EFFECTS ON STATISTICAL PROCESSING (REDUCTION). (Das Phänomen der Persistenz und dessen Auswirkungen bei Statistischen Bearbeitungen). C. Levert. Translated by Marcel I. Weinreich (Sandia Corp.) from Météorologie (4), Nos. 45 and 46, 165-76(1957). 21p. $6.30(ph); $3.00(mf) JCL or LC.

The persistence effect is defined, and its measurement and consequences are discussed. The significance of persistence in the statistical treatment of rainfall data is specifically treated. (D.E.B.)

5701 SCL-T-221
THE INITIATION OF EXPLOSION BY LIGHT. J. Eggert. Translated by Marcel I. Weinreich (Sandia Corp.) from Proc. Roy. Soc. (London) 246A, 240-7 (1958). 12p. $4.80(ph); $2.70(mf) JCL or LC.

By means of a tabular compilation it is shown that a large number of explosion primers can be caused to detonate by brief irradiation with the sparks from energetic electric discharges. In the case of nitrogen iodide there is a weak photochemical effect (5 to 10%); in all other cases initiation is due to the sudden heating of the compounds, a photothermic effect. A number of proofs can be given for this phenomenon. In the case of silver nitride Ag_3N, it is even possible to prepare layers so thin that the ignition (with correspondingly increased energy) can be effected in the area of the incident radiation but cannot be caused to spread to other areas of the layer. These layers are suitable for the making of prints. With equal layer thickness the energy required for the initiation increases with the duration of the igniting spark. (auth)

5702
ELECTRON TEMPERATURE AND ELECTRON NOISE IN HIGH-FREQUENCY TORCH DISCHARGE. Ludwig Mollwo (Deutschen Akademie der Wissenschaften, Berlin). Ann. Physik 2, 97-129(1958). (In German)

The noise temperature of the electron torch was determined at 14,000°K in air and nitrogen at atmospheric pressure at a measuring wave length of $\lambda = 20$ cm. The power and resistivity for the volume were also measured. The discussion shows that 13,500°K is assigned to the electron temperature and 380°K to the shot effect. The gas temperature is about 4000°K. The discharge column is in a state which corresponds to a direct current glow discharge at atmospheric pressure. It was shown that the stabilization of such a state is more easily possible in a high-frequency discharge than in a direct-current discharge. (tr-auth)

5703
THE MAGNETIC PROPERTIES OF THIN ELECTROLYTICALLY DEPOSITED NICKEL LAYERS. W. Ruske (Deutsche Akademie der Wissenschaften, Jena, Ger.). Ann. Physik 2, 274-86(1958). (In German)

The hysteresis loops of numerous electrolytically prepared single and multiple layers in the layer thickness range from 20 to 2×10^4 A were determined with a recording fluxmeter. The principal aim of the investigations lay in the avoidance or separation of the various effects on the magnetic properties of thin layers and the determination of the dependence of the magnetic properties on the layer thickness. (tr-auth)

5704
ALBEDO OF γ-RAYS FROM Co^{60} AND Au^{198} FROM

DIFFERENT MATERIALS. B. P. Bulatov and E. A. Garusov. Atomnaya Energ. 5, 631-7(1958). (In Russian)

Absolute magnitudes of albedos of γ rays from Co^{60} (1.17 and 1.33 Mev) and Au^{198} (0.410 Mev) from various substances at primary beam angles of 0, 45, and 60° were studied. The relation between albedo magnitude and the effective atomic number and thickness of the scatterer and the angular distribution of scattered radiation and its spectral content were determined. The scattered radiation intensity was measured with a gas counter with practically constant sensitivity to γ quanta of various energies. The spectral composition of scattered radiation was determined by absorption in lead. (tr-auth)

5705

ANGULAR DISTRIBUTION OF DOSE OF SCATTERED γ-RAYS FROM Co^{60} SOURCE IN WATER. V. I. Kukhtevich, S. G. Tsypin, and B. P. Shemetenko. Atomnaya Energ. 5, 638-41(1958). (In Russian)

The path of scattered γ radiation from a Co^{60} point source (E_γ' = 1.17 Mev and E_γ'' = 1.33 Mev) with a screening cone was investigated for the case when the cone is placed at the source and for the case when it is placed near the detector. Graphs of the γ-ray dose distribution at various distances are included. (R.V.J.)

5706

A RESONANCE METHOD OF LOCALIZATION AND HEATING OF PLASMA BY VARIABLE ELECTROMAGNETIC PRESSURE. G. A. Askar'yan and M. S. Rabinovich. Atomnaya Energ. 5, 643-4(1958). (In Russian)

A resonance amplitude of volume oscillations of plasma mass modulated along the amplitude by an electromagnetic field, forming pulsating uniformly distributed pressure on the surface of plasma, was investigated. (R.V.J.)

5707

BEHAVIOR OF SMALL PLASMA MASSES IN THE WAVEGUIDE AND ITS INTERACTION WITH CONDUCTIVE WALLS. G. A. Askar'yan. Atomnaya Energ. 5, 644-6(1958). (In Russian)

The radial forces acting on a small plasma mass, in simple wave fields where the mass shifts at any arbitrary distance exceeding its size, are calculated. The forces of plasma mass interactions with conducting walls are evaluated, and certain possible variations of plasma current-carrying pipelines and reflectors are discussed. (R.V.J.)

5708

CURRENT DENSITY EQUILIBRIUM DISTRIBUTION IN STRAIGHT LARGE CURRENT DISCHARGES. L. M. Kovrizhnykh. Atomnaya Energ. 5, 648-9(1958). (In Russian)

The equilibrium distribution is achieved for electron and ion densities in a straight discharge in the presence of additional current flowing along the chamber axis. (R.V.J.)

5709

NEW ISOTOPES OF Sb. I. P. Selinov, Yu. A. Grits, et al. Atomnaya Energ. 5, 660(1958). (In Russian)

Studies were made of the isotopes produced during 10-Mev deuteron bombardment of tin enriched with Sn^{112} (52.3%) and Sn^{114} (57.2%). The reaction products possessed previously unknown activities of $T_{1/2}$ = 7 ± 0.5 and 31 ± 1 min. The upper boundary of the β spectra of both isotopes was close to 2 Mev. It was assumed that the isotopes were produced by reactions $Sn^{112}(d,n)Sb^{113}$ and $Sn^{114}(d,n)Sb^{115}$. (R.V.J.)

5710

THE DIFFUSION OF THORON IN THE EMULSION OF NUCLEAR PLATES. Dan Anghelescu. Bul. Inst. Politehnic Bucuresti 19, No. 3-4, 99-102(1957) July-Dec. (In Rumanian)

The thoron atoms which are generated in the emulsion of a nuclear research plate during its exposure to the desintegration of ThX are able to migrate in the emulsion, producing α stars of the type Tn–ThA–ThC' (or Tn–ThA–ThC). If the plate was not dried after exposure, this migration may cover comparatively long distances (5 to 25 μ) because of the lowered value of the emulsion's viscosity. (auth)

5711

THE PROPERTIES OF RARE EARTH METALS. Pierre-Gilles de Gennes. Compt. rend. 247, 1836-8 (1958) Nov. 24. (In French)

The magnetic properties of the rare earths from gadolinium to thulium were analyzed. The results indicated that the long distance and the oscillating character of the indirect couplings are the basis for the abnormal magnetic properties of the rare earth metals. (J.S.R.)

5712

COMPARATIVE DETERMINATION OF THE CHARACTERISTICS OF EXPLOSIVE WAVES IN GASEOUS MIXTURES. Jacques Brossard and Numa Manson. Compt. rend. 247, 2105-8(1958) Dec. 10. (In French)

The characteristics of a burning gas immediately behind the explosive wave in a gaseous mixture can be determined from the $D(P_1,T_1)$ law deduced from measurements of the velocity D of the explosive wave at different initial pressures P_1 and temperatures T_1 of the explosion. As the experiments specifying this law are few, an investigation was made to determine if it was possible to deduce enough of the elements for an approximate calculation of the characteristics. The characteristics calculated for mixtures of hydrogen and oxygen, ethene and oxygen, and hydrogen, oxygen, and nitrogen are tabulated and compared with *a priori* calculations made previously. (J.S.R.)

5713

ELECTRONS PRODUCING A PENETRATING X-RAY EMISSION OF POWERFUL PULSE DISCHARGES. I. M. Podgornyi, N. G. Kovalskii, and V. E. Palchikov. Doklady Akad Nauk S.S.S.R. 123, 825-7(1958) Dec. 11. (In Russian)

Experimental facts indicated the unique origin of neutron and x-ray emission in powerful deuterium discharges in hydrogen. The energy of electrons responsible for the hard quantum x-ray emissions was measured. Direct experiments show that electrons responsible for the appearance of the x rays following a powerful pulse discharge in hydrogen are accelerated along the discharge chamber axis. The maximum recorded electron energy was 300 ± 20 kev, in good agreement with measurements of the x-ray spectrum energy boundary. (R.V.J.)

5714

TRANSFER OF HEAT FROM NORMAL TO SUPERFLUID PHASE OF LIQUID HELIUM. V. T. Khozyainov (Steklov Inst. of Math., Academy of Sciences, USSR). Doklady Akad Nauk S.S.S.R. 123, 835-7(1958) Dec. 11. (In Russian)

The problem of thermal energy transfer from normal to superfluid helium (or from classical to quantum fluid) was analyzed, as well as the stationary boundary which is present between these two modifications in spite of the turbulent condition (turbulent heat transfer) in the normal helium. (R.V.J.)

5715

CORRELATION FUNCTIONS FOR A SYSTEM OF PARTICLES CARRYING LIKE CHARGES. V. P. Galaiko and L. E. Pargamanik (Gor'kii Khar'kov State Univ.). Doklady Akad. Nauk S.S.S.R. 123, 999-1002(1958) Dec. 21. (In Russian)

The correlation functions for charged particles with nonuniform interaction distances were developed by the method of iterations (the iteration method was previously mentioned by N. N. Bogolyubov for the case of Coulomb interactions) which permits corrections of arbitrary approximations and elucidates the physical aspects of the method. The suggested method can be applied to particle systems with various signs and to the kinetic theory of charged particles. (R.V.J.)

5716

TEMPERATURE OF SPARK DISCHARGE CHANNEL. M. P. Vanyukov and A. A. Mak. Doklady Akad. Nauk S.S.S.R. 123, 1022-4(1958) Dec. 21. (In Russian)

The temperatures in spark discharge channels in argon, xenon, and nitrogen were measured along the channel spectral luminosity density at wave lengths corresponding to the gravity center of lines and at various energy entrance rates. The linear emissions were studied in argon at wave length λ 4806, 4348, and 3588 A; in xenon at λ 2900 and 2600 A. It was found that the temperature of the spark discharge channel is not dependent on the energy entrance rate. The obtained channel discharge temperature in nitrogen ($T \approx$ 43,000°K) agrees well with the published data on nitrogen temperature obtained by spectroscopic methods. It is assumed that the temperature distribution across the spark discharge channel is uniform. The obtained results are given for the case of opened spark discharge; in the case of discharge channels restricted by capillary walls or pinch effect the temperature should be higher. (R.V.J.)

5717

AN ACCEPTANCE SAMPLING PLAN BASED ON THE DISTRIBUTION OF THE RANGE WHEN SAMPLING FROM A TRIANGULAR POPULATION. B. Ostle and J. M. Wiesen (Sandia Corp., Albuquerque, N. Mex.). Industrial Quality Control 15, No. 3, 2p.(1958). Sept.

The distribution of the range of a sample of n from a right triangle population is expressed in terms of the range of the population. This is applied to an acceptance sampling problem in which the sample range is the characteristic of importance. The effect of double inspection—not double sampling—is considered. Numerical values are given for samples of 10 and 20. (auth)

5718

RESONANCES IN SUCCESSIVE OSCILLATING FIELDS. Norman F. Ramsey (Harvard Univ., Cambridge, Mass. and N.A.T.O., Paris). J. phys. radium 19, 809-15(1958) Nov. (In French)

A general method for calculating the shapes of resonances under different circumstances is described. Although the technique used can be applied to resonance experiments in general, the applications will be to molecular beam magnetic resonances. With the method, the velocity distribution, the strength of the uniform magnetic field, and the amplitudes and phases of the oscillatory field may vary arbitrarily along the molecular path; as many as nine frequencies perturbing any combination of three energy levels may be present simultaneously. Results are presented showing the shapes and distortions of the observed resonance under various conditions. Results are described for 2, 3, 4, and infinitely many successive oscillatory fields. The resonance shape was calculated when there is a storage box between the two oscillatory fields from which the atoms emerge only randomly. The effects of gradual applications of the oscillatory field were calculated as well as the effect of different amplitudes of the two oscillatory fields of the separated oscillatory field method. The effects of two different but nearly equal successive frequencies in distorting the resonances are shown both theoretically and experimentally. The presence of a third energy level can distort the resonance under some circumstances. Finally, effects of non-uniform magnetic fields and of phase variations of the oscillatory field are shown. (auth)

5719

DOUBLE RESONANCE IN ATOMIC JETS. G. O. Brink and W. A. Nierenberg (Univ. of California, Berkeley). J. phys. radium 19, 816-18(1958) Nov. (In French)

Transitions that are not otherwise observable in an atomic beam flop-in apparatus were observed by means of a double resonance technique. The method was used to observe the $\Delta F = 0$ transitions in K^{39}, and involves the use of three r-f hairpins through which the beam passes in succession. The frequency of the r-f in the first and third hairpins is adjusted to produce the transition $(2,-1) \longleftrightarrow (1,-1)$. If an atom enters the transition region in the state $(2,-1)$, it will go to $(1,-1)$ in the first hairpin and then back to $(2,-1)$ in the third. Thus a small signal will be seen at the detector. If the transition $(1,-1) \longleftrightarrow (1,0)$ is excited in the second hairpin, some of the atoms that have gone from $(2,-1)$ to $(1,-1)$ will go to $(1,0)$ and will not go back to $(2,-1)$ in the third hairpin. An increase in detector reading will thus be seen when the transition $(1,-1) \longleftrightarrow (1,0)$ is excited. All of the possible $\Delta F = 0$, $\Delta M = \pm 1$ transitions were observed in the case of K^{39} by choosing the proper $\Delta F = \pm 1$ transition. Certain precautions are necessary, however, to observe some of them. The transitions $(2,0) \longleftrightarrow (1,-1)$ and $(2,-1) \longleftrightarrow (1,0)$ are an unresolved doublet. If these transitions are excited in the first and third hairpin, the transitions $(2,0) \longleftrightarrow (2,-1)$ or $(1,-1) \longleftrightarrow (1,0)$ cannot be observed when they are excited in the second hairpin. This is found to be generally true; that whenever the $\Delta F = \pm 1$ transition involves both of the levels of the $\Delta F = 0$ transitions, the latter cannot be observed. In order to observe these $\Delta F = 0$ transitions, the $\Delta F = \pm 1$ transition $(2,0) \longleftrightarrow (1,0)$ must be excited in the first and third hairpins. Certain of the $\Delta F = 0$ transitions form doublets, the components of which are separated by $2g_I\mu_0 H$. It is hoped to use this technique to measure nuclear magnetic moments of radioactive nuclei. (auth)

5720

THEORY OF EXCITED PLASMA WAVES. Masao Sumi (Electrical Communication Lab., Tokyo). J. Phys. Soc. Japan 13, 1476-85(1958) Dec.

The excitation of oscillations in a uniform plasma by an injected electron beam is considered. The dispersion relation for this system is derived by means of

Fourier-Laplace transform method. The solutions of the dispersion relation are obtained which yield the characteristics of excited waves: the frequency, the phase velocity, and the time rate of wave growth as functions of the wave number. It is demonstrated that the wave characteristics are varied by the influence of thermal velocity of electrons in the main plasma and by taking the ratio of electron density in the beam to that in the main plasma over a wide range of values. It is then examined that both the velocity spread in the beam and collisions in the medium have the decaying effect on the growing wave. By the use of the above results the case is also discussed where the main plasma is bounded by ideally thin sheaths. (auth)

5721

OBSERVATIONS OF THE RADIOACTIVITY OF AIR PARTICLES. Fritz Bauer and Gertrud Keck (Univ. of Vienna). Naturwissenschaften 45, 627(1958). (In German)

In the monitoring of air particles an anomalous variation in the activity was detected. It was determined that the anomaly was caused by a single strongly active particle. (J.S.R.)

5722

NUCLEAR RADIATION HEATING: PRELIMINARY DESIGN CONSIDERATIONS. Barney L. Byrum and John A. Biggerstaff (Martin Co., Baltimore). Nuclear Sci. and Eng. 5, 28-31(1959) Jan.

Quick engineering estimates of nuclear radiation heating effects exterior to reactors are frequently desired in preliminary flight vehicle design. A technique that is useful for such evaluations is presented. Analogies are suggested among the capture, inelastic scattering and neutron-induced charge particle processes; a means is provided for treating neutron interactions giving rise to gamma rays of various discrete energies; and a cosine distribution of the core gamma radiation is discussed. (auth)

5723

ITERATIVE SOLUTIONS TO THE P_l AND DOUBLE-P_l EQUATIONS. E. Gelbard, J. Davis, and J. Pearson (Westinghouse Electric Corp., Pittsburgh). Nuclear Sci. and Eng. 5, 36-44(1959) Jan.

The spherical harmonics approximation of lth order, applied to the transport equation in slab geometry, leads to 2l + 1 coupled first order differential equations. These may be transformed into (2l + 1)/2 second order differential equations similar, in form, to the few-group diffusion equations, and amenable to solution by well-known iterative techniques. The double-P_l equations of Yvon may be manipulated and solved in the same manner. This article describes an IBM 704 code which makes use of such a method. Some of the results obtained with the code are discussed, and machine times for typical problems are compared with times required to solve the same problem by the discrete ordinate methods. (auth)

5724

CALCULATION OF THERMAL UTILIZATION IN HETEROGENEOUS NUCLEAR REACTORS BY THE P_3 SPHERICAL HARMONICS APPROXIMATION. T. Asoka. (Japan Atomic Energy Research Inst., Tokyo). Nuclear Sci. and Eng. 5, 57-60(1959) Jan.

Using the spherical harmonics method, a universal method for calculating the thermal utilization f is derived by matrix formalism for a heterogeneous reactor with an elementary cell that contains an arbitrary number of concentric cylindrical shells. Matrix elements in the P_3 spherical harmonics approximation are obtained and an approximate f-expression by the P_3 approximation is derived in a simple and general form as by the ordinary diffusion theory. Finally, f is calculated for two typical cells for a natural uranium heavy-water reactor system and compared with those results for f obtained by the diffusion approximation or the exact P_3 approximation. (auth)

5725

FAST FISSION EFFECT IN LATTICES OF NATURAL URANIUM AND HEAVY WATER. A. H. Futch, Jr. (E. I. duPont de Nemours and Co., Aiken, S. C.). Nuclear Sci. and Eng. 5, 61-7(1959) Jan.

The ratio, δ, of U^{238} to U^{235} fissions was measured for various natural uranium fuel assemblies in D_2O-moderated reactor lattices. Fuel element types studied included clusters of from one to nine 1-in. rods, tubular assemblies, and plate assemblies. The measurements were made by comparing the activations of depleted and natural uranium foils after irradiating them inside the fuel assemblies in an exponential facility. As a corollary to these experiments, relative decay rates were determined for the gamma activities of the U^{238} and U^{235} fission products. (auth)

5726

THE EQUATION OF STATE OF SOLID HELIUM. J. S. Dugdale (National Research Council, Ottawa). Nuovo cimento (10) 9, Suppl. No. 1, 27-31(1958).

The method used to derive the equation of state and the results obtained using the equation are presented. Data given include isochores, lattice energies, Debye temperatures, and Gruneisen γ and melting temperatures. (D.E.B.)

5727

PROPERTIES OF SOLID ARGON. E. R. Dobbs, B. F. Figgins, and G. O. Jones (Univ. of London). Nuovo cimento (10) 9, Suppl. No. 1, 32-5(1958).

Accurate determinations were made of the density and expansivity of solid argon down to 20°K, using x-ray-diffraction techniques. The specific heat was determined down to about 15°K. Density measurements show that the expansivity is about double the previously assumed value. (A.C.)

5728

STRUCTURAL DYNAMICS OF WATER BY NEUTRON SPECTROMETRY. B. N. Brockhouse (Atomic Energy of Canada, Ltd., Chalk River, Ont.). Nuovo cimento (10) 9, Suppl. No. 1, 45-71(1958).

An extensive series of measurements on light water by neutron diffraction and spectrometry and less extensive measurements on heavy water are presented. Experimental methods are discussed. The results were analyzed by comparison with calculations for crystals and gases. The results are not good enough to enable a complete solution of the problem to be given but permit some unambiguous statements to be made about the dynamical nature of liquids in general and of water in particular. (A.C.)

5729

ATOM MOVEMENTS IN SIMPLE LIQUIDS BY TRACER TECHNIQUE. G. Careri (Univ. of Padua). Nuovo cimento (10) 9, Suppl. No. 1, 72-6(1958).

The purpose of the investigation is to show the possibilities of the tracer method in the study of some simple liquids. The following liquid systems were in-

vestigated: (a) liquid indium and indium–lead solutions, (b) liquid nitrogen–argon and nitrogen–tritium mixtures, and (c) liquid He^3–He^4 mixtures and pure liquid helium. A method was developed to measure diffusion coefficients for metals in a wide range of temperature by letting two rods of active and nonactive material diffuse together in a capillary. Lodding measured the self-diffusion in indium by a different technique and found some lower values. An investigation by Paoletti and Vicentini has resulted in the conclusion that both of the above techniques give the same results if capillaries of the same material and same diameter are used. The conclusion is reached that diffusion is larger at the core than at the walls. A new technique was devised for producing ions directly in liquid helium and measuring their mobility under well defined conditions. (A.C.)

5730

THE INFRARED SPECTRUM OF LIQUID AND SOLID HYDROGEN. E. J. Allin, H. P. Gush, W. F. J. Hare, and H. L. Welsh (Univ. of Toronto). Nuovo cimento (10) 9, Suppl. No. 1, 77-83(1958).

The results of the observations on the spectrum of liquid and solid hydrogen are summarized. The most outstanding feature of the observations on the fundamental band is the prevalence of double transitions. In solid hydrogen the double transition is more intense than the single transition, whereas in gaseous hydrogen the two transitions have approximately equal intensities. (A.C.)

5731

THE THERMAL CONDUCTIVITY OF CONDENSED HELIUM. J. Wilks (Clarendon Lab., Oxford). Nuovo cimento (10) 9, Suppl. No. 1, 84-94(1958).

At low temperatures the thermal conductivity of a condensed phase is very sensitive to structure, and the various phases of condensed helium exhibit a wide range of behavior. The two stable isotopes, He^3 and He^4, obey different statistics. The behavior of the solids and liquids at higher temperatures is not greatly different from other simple solids and liquids. The measurements which have been made on the conductivity of condensed helium are reviewed, and the information which may be obtained from them is discussed. (A.C.)

5732

THE PROPERTIES OF ISOTOPIC LIQUIDS. A. Bellemans (Univ. of Brussels). Nuovo cimento (10) 9, Suppl. No. 1, 181-8(1958).

Experimental measurements indicated differences in the intermolecular forces of molecules having the same molecular masses and different isotopic compositions. Measured values for specific hydrogeno- and deutero-compounds are cited. The quantum rotational effects contributing to these differences are developed and lead to an expression which indicates the differences are based on the symmetry of the molecule. (D.E.B.)

5733

LIQUID HELIUM AS A QUANTUM LIQUID. J. De Boer (Univ. of Amsterdam). Nuovo cimento (10) 9, Suppl. No. 1, 199-227(1958).

The position of liquid helium among other liquids is outlined. Discussions are included on the ground state at T = 0, the equilibrium theory of thermal excitations, and the hydrodynamics of these. Finally, some remarks on the theoretical difficulties encountered in describing the thermal excitation are given. (A.C.)

5734

RECENT EXPERIMENTS ON SUPERFLUIDITY. K. Mendelssohn (Clarendon Lab., Oxford). Nuovo cimento (10) 9, Suppl. No. 1, 228-33(1958).

In experiments on the passage of liquid helium through narrow slits and capillaries it was noted that, besides astonishingly high flow rate, the transport of liquid appeared to be highly independent of pressure head. Earlier observations on helium transport in wider capillaries did not support this idea. Keesom and his co-workers were able to show that friction in liquid helium seemed to set in gradually. In order to investigate this question further, flow experiments through narrow slits and compressed powder were carried out which showed the existence of a critical velocity. It was also shown that when the slit width was increased to 10^{-3} cm the phenomena became obscured by the motion of normal fluid which was carried in the flow. (A.C.)

5735

QUANTUM HYDRODYNAMICS AND THE THEORY OF HELIUM II. A. Thellung (Univ. of Birmingham). Nuovo cimento (10) 9, Suppl. No. 1, 243-55(1958).

The development of quantum hydrodynamics is closely connected with the theory of He II, and in particular Landau's theory. In 1941 and 1947 Landau postulated his energy spectrum for a liquid near absolute zero, from which he was able to derive and predict many of the properties of He II. Quantum hydrodynamics has mainly been set up as an attempt to explain this energy spectrum. (auth)

5736

BOSE-EINSTEIN CONDENSATION IN LIQUID HELIUM. O. Penrose (Imperial Coll., London). Nuovo cimento (10) 9, Suppl. No. 1, 256-61(1958).

Four theorems, based on Bose-Einstein considerations, are advanced which appear to explain the unique hydrodynamic characteristics of helium II. (D.E.B.)

5737

CONTRIBUTION TO THE PHONON THEORY OF FLUIDS. R. Eisenschitz and A. Crowe (Univ. of London). Nuovo cimento (10) 9, Suppl. No. 1, 262-6(1958).

The phonon concept was applied in the calculation of the velocity of sound in liquid helium. The calculated velocity is 5.5×10^5 cm per sec; the experimentally measured velocity is 0.24×10^5 cm per sec. (D.E.B.)

5738

ENERGY FLUCTUATIONS IN LIQUID HELIUM AND ITS FLOW PROPERTIES. O. K. Rice (Univ. of North Carolina, Chapel Hill). Nuovo cimento (10) 9, Suppl. No. 1, 267-85(1958).

The relation between the elementary theory of excitations in helium, based on a cell model and the theory of Feynman, are discussed, and it is concluded that these theories can be correlated. In the theories of Feynman and Landau, however, the energy levels are closely associated with specific values of the momentum, while in the author's view they may not be so closely connected. If this latter view is correct, a re-examination of the mechanism of superfluid flow with respect to normal flow is required. This problem is considered. After a preliminary discussion of some of the properties of rotons with respect to superfluids, it is shown that energy fluctuations are capable of producing local temperature gradients which are much greater than any which are likely to be superimposed in experiments on second sound. There will thus be localized flow phenomena which will play an important role in determin-

ing the properties of rotons. Some of the factors involved are discussed. (A.C.)

5739

ON THE STRUCTURE OF LIQUID ^{4}He. S. Franchetti (Univ. of Florence). Nuovo cimento (10) 9, Suppl. No. 1, 286-90(1958).

Fundamental eigenfunctions are developed for a system of Bose atoms. The formula obtained is then used to obtain the radial distribution function. The calculated distribution is compared with experimental results. Variations in the distributions are discussed. (D.E.B.)

5740

VELOCITY OF SOUND IN LIQUID HELIUM. A. Van Itterbeek (Inst. voor Lage Temperaturen en Technische Physica, Louvain, Belgium). Nuovo cimento (10) 9, Suppl. No. 1, 291-6(1958).

Graphical representations are shown (velocity of sound as a function of temperature) indicating the peculiar behavior of sound in liquid helium between 0.1 and 4°K. A series of measurements was carried out at 1.1°K using an acoustic interferometer. The results of the measurements are tabulated. (A.C.)

5741

NUCLEAR ALIGNMENT IN LIQUID AND SOLID ^{3}He. W. M. Fairbank and G. K. Walters (Duke Univ., Durham, N. C.). Nuovo cimento (10) 9, Suppl. No. 1, 297-305 (1958).

Nuclear magnetic resonance experiments designed to measure directly the behavior of the nuclear spin system of helium-3 as absolute zero is approached are discussed. The temperature dependence of the nuclear susceptibility was measured by observing the strength of the nuclear resonance absorption signal. The experimental results are shown graphically. It appears from this experiment that the nuclear spins of liquid helium line up antiparallel as would be expected of an ideal gas, but at temperatures an order of magnitude lower. At the lowest temperatures, the susceptibility became independent of temperature as expected but with a constant value of about 10 times greater than the analogous gas model. It is pointed out that the specific heat data also seem to indicate spin ordering below 0.5°K but do not bear the same type of relationship to an ideal gas as shown by the susceptibility. (A.C.)

5742

SOME COMMENTS ON THE THEORY OF LIQUID ^{3}He. M. J. Buckingham (Duke Univ., Durham, N. C.). Nuovo cimento (10) 9, Suppl. No. 1, 306-9(1958).

At low temperatures the stable isotopes of helium provide condensed states of the simplest systems. It is known, however, that they are far from providing the simplest condensed states. They are unique in remaining liquid under their vapor pressures down to the lowest temperatures. Extrapolation of existing specific heat measurements to lower temperatures indicates that the value is about twice that of an ideal gas of the same particle mass and density as liquid helium-3. Experimental results for specific heat measurements of the liquid under pressure are not yet available. (A.C.)

5743

SOME PROPERTIES OF LIQUID ^{3}He. B. Weinstock, B. M. Abraham, and D. W. Osborne (Argonne National Lab., Lemont, Ill.). Nuovo cimento (10) 9, Suppl. No. 1, 310-19(1958).

The heat of vaporization of helium-3 is shown to vary with temperature. There is a close agreement between the curve obtained from experimental data and the one calculated from the vapor pressure equation. The Argonne measurements from 0.23 to 2°K, along with the data of Roberts and Sydoriac, are shown graphically. The curves are in good agreement. (A.C.)

5744

SOME EXPERIMENTS WITH ^{3}He-^{4}He MIXTURES. K. W. Taconis and D. H. N. Wansink (Kamerlingh Onnes Lab., Leyden, Netherlands). Nuovo cimento (10) 9, Suppl. No. 1, 320-4(1958).

An apparatus is described which was designed for the study of the vapor-liquid equilibrium and osmotic pressure of dilute mixtures of helium-3 and helium-4. The experimental results are shown graphically. Experimental and theoretical results are in complete agreement. (A.C.)

5745

SECOND SOUND IN ^{3}He-^{4}He MIXTURES. H. A. Fairbank (Yale Univ., New Haven). Nuovo cimento (10) 9, Suppl. No. 1, 325-33(1958).

The addition of helium-3 to liquid helium-4 influences the property of the liquid in several ways. One property that undergoes a drastic and significant change on the addition of even small amounts of helium-3 is the velocity of second sound. Detailed measurements of the velocity of second sound in pure helium-4 have played an important role in guiding and checking theory. Second sound is also a useful probe for studying the properties of superfluid helium-3–helium-4 mixtures. A series of second sound experiments are described with particular reference to the information given on the normal component density of the liquid mixtures, the helium-4 effective mass, the lambda transition temperature, and the transition to two-liquid phases. (A.C.)

5746

INFLUENCE OF ^{3}He ON SOME FLOW PROPERTIES OF He II. J. G. Dash and R. D. Taylor (Los Alamos Scientific Lab., N. Mex.). Nuovo cimento (10) 9, Suppl. No. 1, 334-40(1958).

The effects of helium-3 addition on the fluid density, normal fluid viscosity, and critical velocity of helium-4 were determined. These effects are shown in plots of the data, and their agreement with calculated values are discussed. (D.E.B.)

5747

ISOTOPIC MIXTURES. I. Prigogine and A. Bellemans (Univ. of Brussels). Nuovo cimento (10) 9, Suppl. No. 1, 342-4(1958).

An equation is developed which shows that the excess free energy of a mixture of two isotopes is approximately equal to the work spent in changing the molar volumes of the two components into the molar volume of the mixture ($g^E \simeq g^M$). (D.E.B.)

5748

THE STATISTICAL THERMODYNAMICS OF A ONE-DIMENSIONAL MULTICOMPONENT ASSEMBLY. H. C. Longuet-Higgins (Univ. Chemical Lab., Cambridge, Eng.). Nuovo cimento (10) 9, Suppl. No. 1, 345-6(1958).

It is shown that a one-dimensional multicomponent mixture with nearest neighbor interactions obeys the implicit equation of state. A one-dimensional solution is shown to be ideal if, and only if, the matrix is of rank unity. Equations for the determination of the excess free energy of a nearly ideal solution are developed. (D.E.B.)

5749

ON THE CONSISTENCY OF SCHWINGER'S ACTION PRINCIPLE. T. W. B. Kibble (Univ. of Edinburgh).

Nuovo cimento (10) 10, 417-27(1958) Nov. 1.

The conditions for consistency of the equations of motion and commutation relations derived from Schwinger's action principle are investigated. For consistency, it is, in particular, necessary that the time-derivative of equal-time c-number commutators should vanish. It is shown that, under certain assumptions, the theory is consistent if the interaction terms in the Lagrangian are written in a suitably symmetrized form, identical with that required for invariance under SR, and that in general only theories which are equivalent to such "symmetrized" theories can be consistent. (auth)

5750

GAUGE INVARIANCE IN THE THEORY OF SUPERCONDUCTIVITY. D. Pines and J. R. Schrieffer (Laboratoire de Physique, Ecole Normale Supérieure, Paris). Nuovo cimento (10) 10, 496-504(1958) Nov. 1.

It is shown that when due account is taken of the Coulomb interactions between electrons, a theory of superconductivity which gives a satisfactory account of the Meissner effect in the London gauge can be extended to give a satisfactory account in any other gauge. Calculations based on the Bardeen-Pines collective treatment of the electron-phonon system show that in the long wave length region only the plasmons respond to a longitudinal vector potential. Their response is such as to maintain gauge invariance. The individual electrons are surrounded with a screening cloud of virtual plasmons in such a way that they carry no longitudinal current and are unaffected by a longitudinal vector potential. The introduction of the screening cloud is shown to correspond closely to the backflow introduced by Feynman and Cohen to guarantee longitudinal current conservation for the excitations in liquid helium. The calculations are carried out, and involve the use of the random phase approximation for terms which couple plasmons and electrons. For the wave lengths of importance in the Meissner effect, these approximations are well justified. An explicit prescription is given for extending the Bardeen, Cooper, and Schrieffer derivation of the Meissner effect to an arbitrary gauge, and their results are shown to be essentially unaltered. (auth)

5751

TWO-STAGE MODEL OF FERMI INTERACTIONS. N. Byers and R. E. Peierls (Univ. of Birmingham, Eng.). Nuovo cimento (10) 10, 520-4(1958) Nov. 1.

The model of Fermi interactions which involves an intermediate charged boson of spin one is formulated and found to be capable of reproducing all the results of the direct interaction theory with A and V coupling provided the mass of the intermediate particle is sufficiently large. The only apparent difficulty for the model is the predicted radiative decay of the muon. (auth)

5752

GRAPHICAL METHOD FOR THE ANALYSIS OF BUBBLE CHAMBER PICTURES. V. Borelli, P. Franzini, et al. (Univ. of Bologna, Univ. of Pisa, and Istituto Nazionale di Fisica Nucleare, Bologna and Pisa). Nuovo cimento (10) 10, 525-30(1958) Nov. 1.

A simple method for the analysis of bubble chamber pictures is described. It is sufficiently precise for most work and has been successfully used during the last year. Some details of practical interest are included. (auth)

5753

MOMENTUM TRANSFER CROSS-SECTION IN THE THOMAS-FERMI THEORY. T. Tietz (Univ. of Lódź, Poland). Nuovo cimento (10) 10, 531-3(1958) Nov. 1.

The momentum transfer cross section is calculated in the first Born approximation for the Thomas-Fermi field. The elastic collisions of electrons with molecules are defined as those encounters which leave the initial state of the molecule unperturbed. In this case the molecule is left in its normal state. (W.D.M.)

5754

SYMMETRY PROPERTIES OF CLEBSCH-GORDON'S COEFFICIENTS. T. Regge (Istituto Nazionale di Fisica Nucleare, Turin). Nuovo cimento (10) 10, 544-5 (1958) Nov. 1.

5755

A REMARK ON CONSERVATION RULES. P. Roman (The Univ., Manchester, Eng.). Nuovo cimento (10) 10, 546-50(1958) Nov. 1.

The unambiguity of the differential quantities of a system is investigated. If a physical system is characterized by an action integral extended over an arbitrary space-time region, then the equations of motion are the Euler-Lagrange equations. (W.D.M.)

5756

A COMPARISON OF THE BORN AND THE ASYMPTOTIC W.K.B. APPROXIMATION FOR THE PHASE SHIFT. T. Tietz (Univ. of Lódź, Poland). Nuovo cimento (10) 10, 553-6(1958) Nov. 1.

The validities of the Born and asymptotic W.K.B. approximations for the Coulomb potentials of the nucleus which is modified by the screening effect of the orbital electrons are compared. (W.D.M.)

5757

EFFECTIVE INTERACTION BETWEEN A SMALL AND A LARGE HAMILTONIAN SYSTEM; POLARIZATION AND ABSORPTION. F. Englert (Université Libre de Bruxelles, Brussels). Nuovo cimento (10) 10, 560-2(1958) Nov. 1. (In French)

Equations describing the properties of a system of particles in interaction with another system containing many less particles are derived. The case where the two systems are composed of electrons interacting by a Coulomb potential is considered. (J.S.R.)

5758

MEASUREMENT OF FAST LUMINESCENCE DECAY TIMES. Herbert Dreeskamp and Milton Burton (Univ. of Notre Dame, Ind.). Phys. Rev. Letters 2, 45-8 (1959) Jan. 15.

A method for measurement of luminescence decay curves of organic scintillators is reported which represents a new approach to the problem. The time "point" of the light signal is first established, and the signal is thereafter amplified. In this way both time resolution and measurements at the far tail of the decay curve are improved. The time resolution by this method is well below 1 mμ sec. (W.D.M.)

5759

IONIZATION OF THE UPPER ATMOSPHERE BY LOW-ENERGY CHARGED PARTICLES FROM A SOLAR FLARE. Harold Leinbach and George C. Reid (Univ. of Alaska, College). Phys. Rev. Letters 2, 61-3(1959) Jan. 15.

Excess ionization of the upper atmosphere at high latitudes following solar flares has been observed on several occasions during IGY, through studies of the

absorption of cosmic radio noise. The event occurring on July 29, 1958, following the class 3 solar flare at 03:03 UT is discussed. The recordings of the 27.6-Mc/sec cosmic noise received on this date at Thule, Greenland, and Barrow and College, Alaska, are shown. Identical receiving equipment, consisting of riometers connected to wide beam vertically-directed Yagi antennas, was used at each station. (W.D.M.)

5760

CROSS SECTIONS OF ELECTRON CAPTURE BY MOLECULES. N. S. Buchel'nikova (Inst. of Physics Chemistry, Academy of Sciences, USSR). Pribory i Tekh. Ekspt. No. 6, 89-93(1958) Nov.-Dec. (In Russian)

An installation is described in which an electron beam, collimated by a meshed membrane and magnetic field (15 to 20 Oe), enters a collector after passing a system of filters. Ions formed in the equipotential region are gathered into a cylindrical collector. The differences in filter contact potentials are compensated with an accuracy of ~0.02 v. A quasimonochromatic method was used in the production of monochromatic electrons. The installation is capable of measuring radiation and dissociation cross sections exceeding 10^{-20} cm^2. The electron energy distribution width is 0.2 to 0.3 ev. The energy scale precision order is 0.02 ev. (tr-auth)

5761

THE STUDY OF FAST IONIZATION PROCESSES IN GAS FLOW BEHIND A SHOCK WAVE. A. A. Brandt and P. Kh. Kurtmulaev (Moscow State Univ.). Pribory i Tekh. Ekspt. No. 6, 94-7(1958) Nov.-Dec. (In Russian)

A method is suggested for measuring the coefficient of thermal ionization in a gas flow following a shock wave expanding in a shock tube at ~3 km/sec. The duration of the recorded ionization process, depending on the velocity of the shock wave, was ~200 μsec. The developed method was capable of measuring with a precision of ~10% the ionization coefficients at a certain finite number of points (10 to 15), uniformly distributed along the process. This in turn permits determination of the ionization pulse duration and the steepness of the wave front. (tr-auth)

5762

SHOCK WAVES IN MEDIA WITH ARBITRARY EQUATIONS OF STATE. G. Ya. Galin (M. V. Lomonosov Moscow State Univ.). Soviet Phys. (Doklady) 3, 244-7 (1958) Mar.-Apr.

Abrupt discontinuities are investigated in media whose internal energies are completely defined by the specific volume and entropy. Shock-type adiabatic curves are presented which, together with the known facts and methods, permit the formulation of the Hugoniot adiabatic curve and the investigation of the properties of a shock front traversal for media with arbitrary equations of state when the partial derivative $(\partial^2 P/\partial V^2)_S$ changes sign along the Poisson adiabatic curve. (J.S.R.)

5763

ON A VARIATIONAL PRINCIPLE IN THE MANY-BODY PROBLEM. N. N. Bogoliubov. Soviet Phys. (Doklady) 3, 292-4(1958) Mar.-Apr.

A new approximation method for the many-body problem is formulated. In this method u,v are taken to satisfy the stationary equations which give a minimum value to the form $\mathcal{E}(u,v)$. The corresponding C_0 is regarded as the wave function of the ground state and $\mathcal{E}(u,v)$ as the energy of the ground state. (J.S.R.)

5764

CALCULATION OF THE NUCLEAR MAGNETIC SHIELDING CONSTANT. I. V. Aleksandrov (Inst. of Chemical Physics, Academy of Sciences, USSR.). Soviet Phys. (Doklady) 3, 325-8(1958) Mar.-Apr.

A method for calculating the magnetic shielding constant σ based on the use of molecular orbitals is proposed. (J.S.R.)

5765

THE VARIATIONAL PRINCIPLE IN THE THEORY OF SUPERCONDUCTIVITY. I. A. Kvasnikov. Soviet Phys. (Doklady) 3, 329-31(1958) Mar.-Apr.

The thermodynamic properties of a superconducting system were investigated by using Bogoliubov's variational method in the theory of superconductivity (Zhur. Eksptl'. i Teoret. Fiz. 34, 1(1958)). In the Hamiltonian describing the system, not only interactions of pairs of electrons with opposite moments are considered, but terms with $2 = 0$ are also considered. When the Hamiltonian is treated by the variational method, a part of the interaction Hamiltonian becomes unessential, whereas the interactions of pairs of particles with opposite momenta and spins are basic. Results are obtained which are asymptotically exact for the simplified model of a superconductor. (J.S.R.)

5766

INTERACTION OF TWO BODIES EMITTING STREAMS OF GAS. K. P. Staniukovich. Soviet Phys. (Doklady) 3, 341-5(1958) Mar.-Apr.

The interaction of two fixed spherical bodies separated by a given distance and emitting an extremely relativistic gas is investigated. The relationships expressing the constant of interaction between the bodies, their masses, their radii, and the gas emitted are derived. (J.S.R.)

5767

THE RATIO OF PHOSPHORESCENCE AND FLUORESCENCE QUANTUM YIELDS AND THE FLUORESCENCE BANK FREQUENCY. V. V. Zelinskii and V. P. Kolobkov. Soviet Phys. (Doklady) 3, 361-4(1958) Mar.-Apr.

The ratio of the phosphorescence and fluorescence quantum yields (q_{ph}/q_{fl}) was investigated for certain phthalimide derivatives. The phosphorescence intensity was compared with the total emission of the phosphorescent solution itself. The fluorescence spectrum was determined from the normalized combined emission spectrum through subtraction of the normalized phosphorescence spectrum reduced by the factor $q_{c.e.}/q_{ph}$ (where c.e. stands for combined emission). The data show that in the majority of cases the ratio q_{ph}/q_{fl} is entirely independent of the nature of the solvent or its state, but is entirely determined by the frequency position of the spectrum. It was concluded that there is a variation of the probability of transition to a metastable state as the position of the fluorescent band changes. (J.S.R.)

5768

IONIZATION DOSIMETRY AND THE ROENTGEN UNIT. Robert Wichard Pohl. Strahlentherapie 107, 1-11(1958) Sept. (In German)

The dosimeters gaged in roentgens have never served for measuring a physical quantity concerning the incident irradiation. They rather measure a state produced in the irradiated body, i.e., a concentration of the absorbed energy. For the exact determination of this state the roentgen now as before remains a

very expedient, always applicable unit; it can be reduced to other units, if ever wanted. The hitherto usual expressions contribute to conceal the real facts: Thus one should not speak any longer of a dose with which a body is irradiated, but of a dose which is produced in the irradiated body. (auth)

5769

MAKING PRECISION MEASUREMENTS WITH OPTICAL TOOLS. J. C. Moody and J. M. Bunch (Sandia Corp., Albuquerque, N. Mex.). Tool Engr. 9p. (1958) Feb.

It is shown how autocollimation and geometry can be applied in the shop as well as in the laboratory for making precision measurements without complex measuring devices. Typical measurements are described. (W.D.M.)

5770

MAGNETO-OPTICAL RESONANCE IN FERROMAGNETICS. G. S. Krinchik (Dept. of Magnetism). Vestnik Moskov. Univ. Ser. Mat. i Mekh. 12, No. 6, 87-98(1957) (In Russian)

Dynamic properties of ferromagnetics in electromagnetic fields were studied at various frequencies from hertz fractions (magnetic viscosity) to millimeter waves (ferromagnetic resonance), followed by studies in the optical (magneto-optical effects) and soft x-ray ranges (structure region below and above Curie point). Results developed for the visible and close infra-red regions are reported. (R.V.J.)

5771

THE STABILITY OF CYLINDRICAL SYMMETRIC PLASMA CONFIGURATIONS WITH VOLUME CURRENTS. K. Hain and R. Lüst (Max-Planck-Institut für Physik, Göttingen, Ger.). Z. Naturforsch. 13a, 936-40(1958) Nov. (In German)

The stability of cylindrical symmetric plasma configuration with volume currents is investigated by the method of small perturbations. The problem is reduced to only one eigenvalue differential equation of second order. For a special current distribution with relatively strong concentration to the axis the eigenvalues are computed numerically. For this current distribution, specially for long wave lengths, instability shows up. The rates of growth for different kinds of pertubations are given as a function of the wavelength. (auth)

5772

THE IONIZATION STATE AND THE RADIATION BY FOREIGN GASES IN A HYDROGEN PLASMA. G. Knorr (Max-Planck-Institut für Physik, Göttingen, Ger.). Z. Naturforsch. 13a, 941-50(1958) Nov. (In German)

An interpolation formula for ionization (and excitation) of ions is proposed, which holds for the whole energy range of the colliding electrons. With the aid of this formula a time constant is computed and discussed, characterizing the time scale with which the ionization equilibrium of heavier ions is established. Elwert's ionization formula is generalized for small parameters $s = \chi_n/kT$ (χ_n = ionization energy). The radiation of impurities, namely, free–free, free–bound, and excitation radiation, are computed and discussed for such a plasma. The interaction of the radiation with the plasma is neglected. (auth)

5773

THE COMPRESSION OF A PLASMA COLUMN IN QUADRUPOLE MAGNETIC FIELDS. Jens Christiansen (Technische Hochschule, Brunswick, Ger.). Z. Naturforsch. 13a, 951-61(1958) Nov. (In German)

The conditions under which the charged particles of a plasma are compressed along the central axis of a static quadrupole magnetic field were investigated. The ion paths appearing in the high-frequency excitation of the plasma were determined, and the density distribution of the ions in the stationary equilibrium state was approximately given. A simple relation was found between the easily measurable characteristic diameter of the plasma column, the temperature of the gases in the central area, and the magnetic force flux density at the surface of the quadrupole magnet. The results were essentially confirmed by experimental investigations on weakly ionized gases. (tr-auth)

5774

THE PATTERN OF THE IMAGE DISTORTION AND THE LINE BROADENING ALONG THE PHOTOPLATE IN MASS SPECTROGRAPHY WHICH HAS DOUBLE FOCUSING OF THE FIRST ORDER FOR ALL MASSES. L. A. König and H. Hintenberger (Max-Planck-Institut für Chemie, Mainz). Z. Naturforsch. 13a, 1025-34 (1958) Dec. (In German)

With the help of a formula derived earlier (Z. Naturforsch. 12a, 140(1957)), the image distortion coefficient and the line broadening were calculated by the image distortion along the rectilinear photoplate in mass spectrographs which have double focusing of the first order for all masses. The image distortion coefficient was represented for apparatuses of the Mattauch-Herzog type, for apparatuses of the Reuterswärd type, and for additional mass spectrographs in diagrams. For the calculation of the line broadening, formulas were derived from the image distortion coefficient and the dimensions of the radiation boundary screen, and numerical examples were calculated for the Mattauch-Herzog apparatus. (tr-auth)

5775

THE THEORY OF SECONDARY ELECTRON EMISSION FROM METALS. H. Stolz and H. W. Streitwolf (Humboldt-Universitat, and Deutschen Akademie der Wissenschaften, Berlin). Z. Naturforsch. 13a, 1100-1 (1958) Dec. (In German)

The equations describing the excitation function for secondary electron emission from metals are derived. (J.S.R.)

5776

PLASMA POLARIZATION AND CARRIER INTERACTION. G. Ecker and K. G. Müller (Univ. of Bonn). Z. Physik 153, 317-30(1958). (In German)

The applicability of the Debye-Hückel theory to plasma is discussed. In addition to the well known Onsager-Kirkwood condition another limitation is found which depends on whether averaging is possible or not. The general formulation of the force on a neutral or charged particle can be simplified by making use of the separation in individual and collective components. The result justifies the polarization approximation used to account for the collective interaction of the system. Moreover, it was found that only that fraction of the individual interaction energy is of importance which shows correlation to the field at the origin. This correlation causes differences in the results for neutral and charged particles. As long as $\delta > 0$ holds, this difference is restricted to large fields. The evaluation was made without using the cutoff approximation. Furthermore, the relations are investigated near the limit $\delta = 0$. (auth)

5777
THE PHOTOCONDUCTIVITY OF GERMANIUM AFTER IRRADIATION WITH FAST ELECTRONS.
F. Stöckmann, E. E. Klontz, et al. (Purdue Univ., Lafayette, Ind.). Z. Physik 153, 331-7(1958). (In German)

After irradiation with fast electons, a photoconductivity up to approximately 6μ was detected in Ge. The spectral distribution of the photoconductivity and its variation during the irradiation gave an indication on the properties of the fault which occurs after electron irradiation. In heat treatments after the electron irradiation irreversible changes occurred. Restoration methods were investigated in this manner. (tr-auth)

5778
WORK FUNCTION OF THIN FILMS OF THORIUM OXIDE AND THORIUM ON TUNGSTEN. A. R. Shulman (Kalinin Leningrad Polytechnic Inst.). Zhur. Tekh. Fiz 28, 1711-13(1958) Aug. (In Russian)

The thermoelectric emission of fresh nonactivated, activated, and oxidized films of thorium on tungsten layers was studied at cathode activation temperature of 1300 to 1650°K. The results of the tests were in good agreement with the published data on tests made with thorium and thorium oxide films on platinum and molybdenum layers. (R.V.J.)

5779
VIBRATIONS OF THE ELECTRON PLASMA IN THE EXTERNAL ELECTRIC AND MAGNETIC FIELDS.
K. N. Stepanov and B. S. Tkalich (Inst. of Physics and Tech., Khar'kov). Zhur. Tekh. Fiz 28, 1789-1800(1958) Aug. (In Russian)

Propagation of electromagnetic waves in plasma in intersecting electric and magnetic fields was studied, considering the thermal motion of electrons. A detailed study was made of the behavior of plasma waves. (tr-auth)

5780
ON THE MAGNITUDE OF THE PARTICLE LOSSES CAUSED BY SCATTERING ON RESIDUAL GAS IN SYNCHROTRONS. A. N. Matveev (Moscow State Univ.) Zhur. Tekh. Fiz 28, 1829-36(1958) Aug. (In Russian)

Particle losses caused by scattering on residual gases were calculated with consideration of the betatron oscillation damping in rectangular vacuum chambers. The importance of examining the problem in the four-dimensional phase space is stressed. An efficient method is proposed for estimating the magnitudes of particle losses in vacuum chambers of arbitrary shape. (R.V.J.)

5781
GRAPHO-ANALYTICAL TRACING OF CHARGED PARTICLE PATHS IN ELECTROSTATIC AND MAGNETIC FIELDS. N. I. Shtepa. Zhur. Tekh. Fiz. 28, 2587-2603(1958) Nov. (In Russian)

Grapho-analytical methods for plotting relativistic particle trajectories in electrostatic and magnetic fields are described. The description involves the rate increments, the radius curvatures, and the combined methods. Analysis is made of the basic errors and means for their correction. (tr-auth)

5782
ERRORS IN THE COUNTING OF PULSATING RADIATION. Alessandro Markov (Univ. of Moscow). pp. 237-48 in "Atti del Congresso Scientifico. Volume I. Sezione Nucleare, Giugno 1957." (In Italian)

An analysis is made of the percentage loss of counts in a counting device which is coupled to a two-channel pulse analyzer. The results are applied to the case of pulses randomly distributed in a time interval T and which pulsate with the given frequency f. (J.S.R.)

5783
RADIOBEOBACHTUNGEN DES ERSTEN KÜNSTLICHEN ERDSATELLITEN. (Radio Observations of the First Artificial Earth Satellite.) Wolfgang Priester, Hans-Gerhard Bennewitz, and Peter Lengrüsser. Cologne, Westdeutscher Verlag, 1958. 50p.

From Doppler effect measurements and field intensity recordings of the 20 and 40 MHz signal of the first earth satellite, the orbit and its transient variation caused by precession and friction in the earth's atmosphere was calculated. The value 2.96 ± 0.20 °/d was obtained for the precession of the orbit, in good agreement with the theoretical value. For the air density the value 4.7×10^{-13} g/cm^3 was calculated at a height of 215 km. This value is five times that obtained from the American rocket investigations in 1952 and 1953. (tr-auth)

5784
ELECTRICAL DISCHARGES IN GASES. F. M. Penning. New York, The MacMillan Company, 1957. 80p.

It is felt that this book fulfills a need, offering as it does a concise synopsis which can profitably be used by all scientists concerned in the field of gas discharge as a basis for further study. No attempt is made to give a review of the whole subject; the intention is rather to show by means of examples what mechanisms govern the conduction of electricity through gases in various typical cases. (W.D.M.)

5785
RADIATIONS AND MATTER. André Berthelot. Translation of "Rayonnements de Particules Atomiques, Electrons et Photons." London, Leonard Hill [Books] Limited, 1958. 185p.

The book deals with the characteristics of various types of radiations and their behavior as they pass through matter. Topics treated include the theory of elastic collision, particles in motion, the path, ionization, deceleration, variation of charge, and Coulomb interactions of moving particles, fission fragment slowing down, electrons, and photons. (W.D.M.)

5786
ABSORPTIE VAN GASSEN IN VLOEISTOFFEN, ZONDER EN MET CHEMISCHE REACTIE. (Absorption of Gases in Liquids, With and Without Chemical Reaction.) Reinier Albert Titus Ocko Nijsing. 's Gravenhage, Netherlands, Uitgeverij Excelsior, [1958]. 129p.

A study is made of the transport phenomena in the liquid phase of gas absorption, emphasizing the unsteady-state condition near the gas-liquid interface. Rates of gas absorption were measured into laminar falling liquid films and laminar liquid jets. The equations are given for the absorption of a pure gas into an infinitely thick stagnant liquid. It is shown that, under certain conditions, the theoretical equations may be applied to absorption into ideal falling liquid films and liquid jets. Methods to reduce the hydrodynamic effects of the liquid flow are discussed. Experimental details are given. The absorption of CO_2 into water, electrolyte solutions, jets of sodium hydroxide, potassium hydrox-

ide, and lithium hydroxide solution, falling films of carbonate/bicarbonate buffer solutions, and caustic solutions is investigated. The absorption of SO_2 in water jets is also studied. (J.S.R.)

Elementary Particles

5787 A/CONF.15/P/692

Argonne National Lab., Lemont, Ill. and Chicago. Univ.
SYMMETRY PROPERTIES IN THE DECAY OF POLARIZED NEUTRONS. M. T. Burgy, V. E. Krohn, T. B. Novey, G. R. Ringo, and V. L. Telegdi. 16p. $0.50 (OTS).

Prepared for the Second U. N. International Conference on the Peaceful Uses of Atomic Energy, 1958.

Experiments were made with polarized neutrons to determine the electron distribution, the antineutrino distribution, and the simultaneous electron-antineutrino distribution with respect to the neutron spin. The results showed a preferential emission of the electrons antiparallel to the direction of neutron spin. The antineutrinos were emitted preferentially along the direction of the neutron spin. The measurement of electron-antineutrino distribution indicated no breakdown in the time-reversal symmetry. A comparison of theory and these experimental results shows only right-handed antineutrinos and the combination of axial vector A and vector V couplings with the electron waves out of phase by 180°, i.e., an A-V interaction fits the experimental results. (J.S.R.)

5788 AECU-3995

Iowa. State Univ., Iowa City.
THE PROTON COMPONENT OF THE PRIMARY COSMIC RADIATION. Frank B. McDonald and William R. Webber. [1958]. 53p. (SUI-59-1). $9.30(ph OTS); $3.60(mf OTS).

The proton component was extensively studied at high altitudes in a series of 6 Skyhook balloon flights at various latitudes (4, 41, 53, and 55° geomagnetic) using the Cherenkov scintillation counter technique. The proton differential energy spectrum was measured directly in the region 250 to 750 Mev. It is observed that primary alphas and protons have the same form of rigidity spectrum from 1 to 17 Bev. A series of cutoff rigidities are measured in the vicinity of $\lambda = 53$ and 55°. The intensity and composition of fast splash albedo is determined at $\lambda = 4$, 53, and 55°. Significant time variations are observed between the three high latitude flights. Differences observed in the intensity and energy spectra of these three flights are discussed, and strong restraints are placed on possible modulating mechanism. (auth)

5789 AFOSR-TN-58-1063

Yale Univ., New Haven.
ELECTRIC POLARIZABILITY OF THE NEUTRON. G. Breit and M. L. Rustgi. Dec. 3, 1958. 26p. Contract AF18(600)-771. (AD-207223).

In connection with a proposed explanation of the anisotropy observed in the scattering of neutrons from various elements at energies of a few hundred kev, the order of magnitude of the neutron polarizability is estimated making use of data on photopion production. A polarizability α greater than $\sim 2 \times 10^{-42}$ cm^3 appears unlikely on this basis. There remains an unexplained factor of ~ 50 which has to be accounted for either in the polarizability or by providing another explanation of the neutron scattering anisotropy. The possibility of explaining the anisotropy on the basis of ordinary scattering theory does not appear to be excluded. The exact proportionality of the coefficient of cos θ to the neutron momentum does call for an r^{-4} type of potential, but it is not clear whether the energy dependence of the coefficient is sufficiently well determined by the data and whether the compound nucleus features of the interaction are capable of explaining the observations. Nevertheless, a few less usual effects are estimated. These are the interaction of the neutron moment with the vacuum polarization charge and with the external electric field of the nucleus as well as its interaction with the electric charge density at the nuclear surface. The latter is hard to distinguish from other nuclear effects. The former two effects are small and do not resemble the observed effects. (auth)

5790 NP-7062

Joint Inst. for Nuclear Research, Moscow. Lab. of Theoretical Physics.
DISPERSIONSBEZIEHUNGEN UND CHEW-LOW-GLEICHUNGEN FUR UNELASTISCHE π-MESONEN-PROZESSE MIT FESTER NUKLEONEN-QUELLE. (Dispersion Relations and the Chew-Low Equations for Inelastic π-Meson Reactions with Solid Nucleon Sources.) W. Zöllner. 1958. 19p.

Statistical dispersion relations and Chew-Low equations were formulated for the $\pi + N \rightarrow n\pi + N$ process. It is shown that physically distinct dispersion relations and Chew-Low equations for this process can be obtained by an adjustment of the variables. (tr-auth)

5791 UCRL-8549

California. Univ., Berkeley. Lawrence Radiation Lab.
FORCES BETWEEN NUCLEONS AND ANTINUCLEONS. Geoffrey F. Chew. Nov. 25, 1958. 13p. Contract W-7405-eng-48. $3.30(ph OTS); $2.40(mf OTS).

Existing experimental information about the nucleon-antinucleon interaction is reviewed, and a description is given of a theoretical model, based on the Yukawa theory, which seems able to explain the experimental results. (auth)

5792 UCRL-8559

California. Univ., Berkeley. Lawrence Radiation Lab.
PION PRODUCTION IN NEUTRON-PROTON COLLISIONS AT BEVATRON ENERGIES (thesis). Fred Nels Holmquist. Dec. 4, 1958. 125p. Contract W-7405-eng-48. $2.75(OTS).

Neutrons from a target bombarded by 6.2-Bev protons produced 330 three-prong and 34 five-prong events in a hydrogen-filled cloud chamber. These events were analyzed in an IBM program of constrained solutions. Frequencies for nine different particle configurations are estimated. The energy spectrum of the beam neutrons is obtained. Histograms for center-of-mass (c.m.) momentum and angles as well as Q values between emitted particles and their c.m. angles are shown for the particle configurations. In all of the particle configurations, the two nucleons tend to be emitted in opposite directions in the c.m. system, one going forward and the other going backward. Both the opposite-direction effect and forward-backward effect are greater at Bevatron energies than at Cosmotron energies and decrease as the number of pions produced is increased. In the pn+- reaction, ideograms of $Q(p\pi^+)$, $Q(n\pi^-)$, and especially the sum of these distributions show a good fit to the $T = 3/2$ interaction cross section observed in π^+p scattering, as weighted by the two-body phase-space factor. In the pp reaction, the $Q(p\pi^-)$ dis-

tributions show evidence for the T = 3/2 resonance and the proposed T = 1/2 resonance observed in single π^+ photo-production. In the pn+- reaction, the protons are peaked strongly backward, while in the pn+-0.. and pn++-- the protons tend toward forward emission. In the Q($\pi\pi$) distributions, evidence is found for pion-pion interactions in isotopic spin state T = 2. A proposed phenomenological, directional-isobar model of multiple-pion production is found to be successful in its predictions. In this model it is assumed that each nucleon during a grazing-type collision is excited to the T = 3/2 isobaric state or a higher T = 1/2 isobaric state by absorbing or emitting a single pion, and subsequently decays by single- or double-pion emission. (auth)

5793

A POSSIBLE RELATIONSHIP BETWEEN THE VARIATIONS OF THE LOW ENERGY COMPONENTS OF COSMIC RADIATION AND THE PASSAGE ON THE SOLAR DISK OF SOME OPTICALLY ACTIVE REGIONS. Michel Trellis. Compt. rend. 247, 1964-5(1958) Dec. 1. (In French)

Recordings of cosmic radiation in the last half of 1957 and the first half of 1958 show a sharp decrease in the number of neutrons registered. The decrease has a periodicity of 27.5 days. An extended observation of the solar corona has shown a region of high intensity lasting for a year. It is located at 340° longitude and 20° latitude north. The decrease of neutrons recorded always occurs 4 to 6 days after the passage of the corona jet to the eastern rim of the sun. Data are not yet sufficient to definitely assign to the jet the cause of the decrease of neutrons, but the possibility exists. (J.S.R.)

5794

DISPERSION RELATIONS FOR THE PRODUCTION OF PIONS. V. Tseliner (Joint Inst. of Nuclear Research). Doklady Akad Nauk S.S.S.R. 123, 838-40(1958) Dec. 11. (In Russian)

Dispersion relations were developed for processes evolving $\pi + N \rightarrow 2\pi + N$ for two different spin and isotopic states (non-spin-flip, isotopic spin 3/2). (R.V.J.)

5795

SPIN RESONANCE OF FREE ELECTRONS. H. G. Dehmelt (Univ. of Washington, Seattle). J. phys. radium 19, 866-71(1958) Nov. (In French)

A new experimental technique for the detection of spin resonance of free thermal electrons and the measurement of the spin magnetic moment with appreciable precision is described. The electrons receive their orientation by a first exchange collision with an oriented alkali atom, are then reoriented by spin resonance and in a second exchange collision pass this reorientation on to the atoms whose orientation is monitored by the optical transmission technique, oriented atoms absorbing less resonance light than unoriented ones. Equations describing the atom-free electron orientation interdependence and an equivalent RC circuit are developed which allow to evaluate the spin exchange cross section, Q, from the experimental signal intensities. For sodium, the lower limit $Q \geq 2.3 \times 10^{-14}$ cm^2 is evaluated. This is in agreement with the theoretical upper limit $\overline{Q} = 2.3 \times 10^{-14}$ cm^2. For certain limiting cases the exchange cross section is shown to drop fast with increasing electron energy, E, first like $\sim E^{-1}$ and, even faster, when E approaches the singlet-triplet splitting of bound levels of the negative alkali ion which are assumed to exist close to zero binding energy. This energy dependence determines the choice of experimental methods to generate the free electrons. Workable generation methods are discussed and new experimental results obtained employing photoionization of the alkali atoms are presented. The experimental apparatus is briefly described and an earlier obtained measurement of the sodium ground state free electron spin g-factor ratio $g_J(Na)/g_S = 1.000026 \pm 0.00003$ is cited. Analogous experiments in which another species of alkali atoms takes the place of the free electrons are briefly reported. (auth)

5796

SOME REMARKS ON THE RADIATION REGISTERED BY ILFORD D_1 AND K_0 EMULSIONS DURING THEIR EXPOSURE TO 14-Mev NEUTRONS. Marie Ader. J. phys. radium 19, 913(1958) Nov. (In French)

Ilford D_1 and K_0 emulsions were wrapped in black paper and exposed to a 14-Mev neutron beam. Tracks of protons were found, as well as stars with three branches from the disintegration of carbon. Some tracks similar to two-branched stars caused perhaps by carbon disintegration, with the third alpha particles not having sufficient energy to be observed, were also found. Tracks of isolated alpha particles whose spectra had several peaks were observed. Only the completely horizontal tracks formed in the interior of the emulsion were studied. (J.S.R.)

5797

MULTIPLE NEUTRON PRODUCTION IN A COSMIC RAY NEUTRON MONITOR PILE. M. A. Collins (Victoria Univ. of Wellington, N. Z.). Nuovo cimento (10) 10, 428-34(1958) Nov. 1.

A measurement of the number of neutrons produced in the lead of a paraffin–lead cosmic-ray neutron detector of the Chicago design was made. The experiment indicates that an average of nine neutrons are created per event. (auth)

5798

DETAILED STUDIES OF AN EVENT INVOLVING THE MULTIPLE PRODUCTION OF STRANGE PARTICLES. Tsai-Chü (Faculté des Sciences, Sorbonne, Paris). Nuovo cimento (10) 10, 435-51(1958) Nov. 1.

Three strange particles are emitted from a cosmic-ray star of the type 14 + 5p found in the Sardinia stack S36. They are a negative hyperon captured at rest, a positive hyperon decaying in flight, and a negative K meson interacting in flight. Detailed measurements of each particle are given. The three strange particles are coplanar. Each has the same strangeness number. Evidently there are three pairs of strange particles emitted in this interaction. But if the negative hyperon were an antihyperon, then two pairs should be emitted. It seems very probable that the strange particles are produced through a multiple rather than a plural process. A rough estimate is given of the frequency ratio between multiple production events and all associated events involving two or more identified strange particles. The ratio is of the order 0.02 to 0.07 for two-nucleon interactions in the energy range of about 15 Bev. (auth)

5799

THE KINEMATICS OF MESON INTERACTIONS WITHIN NUCLEI. K. M. Watson and C. Zemach (Univ. of California, Berkeley). Nuovo cimento (10) 10, 452-67 (1958) Nov. 1.

The optical model of the nucleus, which has proved

useful in the study of coherent scattering processes, is applied to the inelastic scattering of π mesons by nuclei. Various aspects of meson and nucleon kinematics as modified by the presence of the optical model potential are discussed. Formulas and numerical results which relate free pion-nucleon cross sections to cross sections for pion-nucleon collisions within nuclei are given. They indicate that the coherent effects described by the optical model play an important role in the inelastic scattering of mesons. (auth)

5800

BUBBLE CHAMBER STUDY OF UNSTABLE PARTICLE PRODUCTION IN π^--p COLLISIONS AT 910, 960, 1200, AND 1300 Mev. F. Eisler, R. Plano, et al. (Brookhaven National Lab., Upton, N. Y.). Nuovo cimento (10) 10, 468-89(1958) Nov. 1.

Results are reported on the total and differential cross sections for the reactions $\pi^- + p \rightarrow \begin{matrix}\Lambda^0 + \theta^0 \\ \Sigma^0 + \theta^0 \\ \Sigma^- + K^+\end{matrix}$ at 910, 960, 1200, and 1300 Mev using hydrogen and propane bubble chambers in a magnetic field of 13.4 kg. The chambers and their operation as well as the method of analysis are described in detail. (auth)

5801

RELATIVISTIC ELECTRON-NEUTRON SCATTERING ACCORDING TO MESON-THEORY. L. K. Pandit (Univ. of Zürich). Nuovo cimento (10) 10, 534-7(1958) Nov. 1.

The calculation of electron-neutron scattering is performed in a manner exactly similar to that of electron-proton scattering. The results are compared with experimental results. The measured electron-neutron scattering cross sections were taken as the difference of the experimental electron-deuteron and electron-proton cross sections. (W.D.M.)

5802

SOME FEATURES OF THE ELECTRON ENERGY SPECTRUM IN THE K_{e3} DECAY PROCESS. S. Furuichi, S. Sawada, and M. Yonezawa (Hiroshima Univ.). Nuovo cimento (10) 10, 541-3(1958) Nov. 1.

It is shown that there exist some characteristic features in the theoretical energy spectrum of the electrons in K_{e3} decay, and the experimental analysis of these simple features seems to be easier than the investigation for the correlation with the pion energy. The electron-pion energy correlation function is given. The ratio of high-energy secondary electrons to low-energy electrons is investigated. (W.D.M.)

5803

SEARCH FOR PARTICLES OF MASS 500 m_e. S. J. Bosgra and F. Bruin (Univ. of Amsterdam). Nuovo cimento (10) 10, 551-2(1958) Nov. 1.

A large stack of G-5 emulsion exposed to the K^+ beam of the Bevatron was investigated for the possible identification of 500 m_e particles. No trace of these particles was found. Various reasons for the negative results are discussed. (W.D.M.)

5804

ELECTRON DECAY OF THE POSITIVE PION. H. L. Anderson, T. Fujii, R. H. Miller, and L. Tau (Univ. of Chicago). Phys. Rev. Letters 2, 53-6(1959) Jan. 15.

The existence of the $\pi \rightarrow e$ mode was confirmed with a branching ratio $f = (\pi \rightarrow e + \nu)/(\pi \rightarrow \mu + \nu)$ very close to the value of 1.28×10^{-4} predicted by the universal A-V theory. A double-focusing magnetic spectrometer modified to accommodate three detectors was used to select the π electrons of energy E = 69.8 Mev. The branching ratio calculated from the data is $f = (1.03 \pm 0.20) \times 10^{-4}$. (W.D.M.)

5805

ASYMMETRY PARAMETER IN MUON DECAY. M. Bardon, D. Berley, and L. M. Lederman (Columbia Univ., New York). Phys. Rev. Letters 2, 56-7(1959) Jan. 15.

The use of muons emitted near the cut-off angle from π^+ decays in flight results in an accurate knowledge of their polarization; and hence in a much smaller uncertainty in the asymmetry parameter. The arrangements used to define the transversely polarized muon beam and for counting the μ-decay electrons are shown. The asymmetry parameter was found to be $|a| \geq 0.325 \pm 0.015$. (W.D.M.)

5806

POSSIBLE DETERMINATION OF KΛ RELATIVE PARITY. Luciano Fonda and J. E. Russell (Indiana Univ., Bloomington). Phys. Rev. Letters 2, 57-9 (1959) Jan. 15.

It has been suggested that a study of the absorption of bound K^- mesons in hydrogen according to the infrequently occurring reactions, $K^- + p \rightarrow \Lambda^0 + \pi^0 + \pi^0$ and $K^- + p \rightarrow \Lambda^0 + \pi^+ + \pi^-$, might yield information regarding the KΛ relative parity. This suggestion is extended to the absorption in flight of K^- mesons with energy below 30 Mev. (W.D.M.)

5807

THE ANGULAR CORRELATION AND POLARIZATION OF BETA PARTICLES IN TRANSITIONS. Br. Kuchowicz (Institut für Kernforschung, Warsaw). Z. Naturforsch. 13a, 999-1001(1958) Nov. (In German)

Formulas for the polarization of beta particles in recoil experiments were given for allowed transitions with $\Delta J = \pm 1$ and single forbidden transitions with $\Delta J = \pm 2$. This investigation can therefore serve to decide between the axial vector and tensor interactions. The possibility of proving the time reversal invariance was discussed. (tr-auth)

Heat Transfer and Fluid Flow

5808 WADC-TR-58-142

Vitro Labs., West Orange, N. J.

INVESTIGATION OF THE HIGH INTENSITY ARC TECHNIQUE FOR MATERIALS TESTING. Period Covered: April 1957 to March 1958. Charles Sheer, C. Dudley Fitz, Laurence H. Mead, John D. Holmgren, Donald L. Rothacker, and Douglas Allmand. Mar. 1958. 107p. Project title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task title: THERMODYNAMICS AND HEAT TRANSFER. Contract AF33(616)-3669. (AD-205364).

Basic studies performed during the second year of a two-year program to evaluate the adaptability of the high-intensity arc flame as a testing medium are described. A more stable and controllable configuration of arc operation, featuring a triple cathode, was developed. The pulse method of measuring tail flame velocity was improved, and the range of measurements extended by using a more powerful electronic pulsing device. A definite peak in the curve of instantaneous velocity versus axial distance along the flame was observed which appeared to shift farther away from the crater as

the ambient pressure is reduced. The maximum velocity achieved was approximately 70,000 cm/sec. The mass density of the flame was measured by means of a dynamometric technique using a disk-shaped model. The results showed a wide discrepancy with values predicted from the ideal gas law. Extensive heat flux measurements were made by calorimetric methods to determine the rate of energy absorption as a function of power input, ambient pressure, and location. The maximum heat absorption rate measured was 1.5 kw/cm^2. Abnormally high heat transfer coefficients were indicated for surfaces in contact with a plasma flame. A photodensitometer method was used to indicate temperature gradients within the flame. These results and earlier temperature measurements are discussed. Several flow visualization techniques were utilized to determine flow patterns of the arc plasma in the vicinity of solid objects. Direct and schlieren photography showed an abnormally thick boundry layer for the flow of plasma near the models; a possible explanation is offered. Finally, attempts were made to measure thermal diffusivities of copper, graphite, molybdenum, and tungsten by inserting appropriate specimens in the flame. Results indicate that the technique of measurement requires further development to obtain reliable measurements using a plasma flame. (auth)

5809 SCL-T-220
MEASUREMENT OF METAL HEAT CONDUCTIVITY IN A WIDE RANGE OF TEMPERATURE DURING A SINGLE EXPERIMENT. (Izmereniye Temperaturoprovodnosti Metallov v Shirokom Intervale Temperatur za Odin Opyt). O. A. Kraev. Translated by Marcel I. Weinreich (Sandia Corp.) from Teploenergetika 4, 69-72(1957). 10p. $3.30(ph); $2.40(mf) JCL or LC.

A new method of measuring the dependence of metallic heat conductivity on temperature during a single experiment is presented. A theoretical foundation of this method, experimental setup, and results of measuring the thermal conductivities of various metals are presented. (auth)

5810
CALCULATION OF HEAT DISTRIBUTION SCHEMES WITH THE HELP OF KIRCHHOFF THEOREMS. Bertrand Weissenbach. Brennstoff-Warme-Kraft 10, 505-7(1958) Nov. (In German)

By an analogy between an electrical current and the mass flow in a pipe on one hand and the electric voltage and the Gibbs thermodynamic potential (called energy) on the other, a simple electrical analog model for the calculation of heat distribution is shown which is identical to the heat transfer system. The electrical transfer system characterized by the current and voltage is proved to be a special case of the general energy flux system, for the determination of which it is necessary to state the medium, the mass flow, and the energy and enthalpy. In heat engineering, energy and enthalpy permit a simple interpretation of the efficiency and their dependence on the environment. (tr-auth)

Nuclear Properties and Reactions

5811 A/CONF.15/P/2483
Brookhaven National Lab., Upton, N. Y.
RECENT CROSS SECTIONS OF INTEREST TO REACTOR DESIGN. Donald J. Hughes. 53p. $0.50(OTS).

Prepared for the Second U. N. International Conference on the Peaceful Uses of Atomic Energy, 1958.

The neutron cross sections which are of particular interest for reactors and for which significant new advances in knowledge have occurred are reported. The thermal cross sections for boron, graphite, fissionable nuclides, and fission products are given. Resonance parameters for U^{233}, U^{235}, and Pu^{239} are tabulated. Partial cross sections and prediction of cross sections from theory are discussed. (J.S.R.)

5812 CRRP-765
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
THE THERMAL NEUTRON TEMPERATURE IN NRX SELF-SERVE POSITIONS S-3-5 AND S-6-3. C. B. Bigham. Sept. 1958. 21p. (AECL-736). $0.50(AECL).

A measurement of relative thermal neutron temperatures based on the determination of relative fission cross sections from measurements of fission product gamma activities is described. The results for two irradiation positions in the NRX reflector were 120 ± 10°C for S-3-5 and 138 ± 10°C for S-6-3. The neutron temperature in the rabbit was used as a reference. (W.D.M.)

5813 NP-7203
Lockheed Aircraft Corp., Marietta, Ga.
EPI—THERMAL DOSE AND ATOMIC PRODUCTION CALCULATIONS. Walter R. Burrus. July 1958. 45p. Contract AF33(600)-32055. (NR-40).

The cross sections for energy absorption were determined for several common elements as a function of energy, and average cross sections were calculated for each of three representative reactor neutron spectra. These average cross sections vary for different spectra, but the variations for the representative spectra selected were no larger than a factor of two. The fraction of the absorbed dose effective in producing atomic displacements was computed for several common metals. It may be multiplied by the absorbed energy to give the energy used in formation of atomic displacements. This two-step calculation has an advantage over a direct calculation of the number of atomic displacements in that the result is completely insensitive to the displacement energy and relatively insensitive to the critical ionizing energy. (auth)

5814 NP-7219
Grumman Aircraft Engineering Corp., Bethpage, N. Y.
NEUTRON ACTIVATION RESEARCH ON SEAPLANE AIRFRAME MATERIALS. Bi-Monthly Report No. 2. A. J. Favale and J. W. Nostrand, Jr. Nov. 1958. 8p. Contract NOas-58-729. (RE-92-PR-2).

A preliminary analysis of the samples to be irradiated was made, and a data reduction program for the IBM 704 was developed. The contractor intends to study the adherence of neutron-activated matter to a typical section of hull bottom, the influence of irradiation on corrosion, and the neutron-induced activation of sea water and other materials including some pure chemical elements. (W.D.M.)

5815 NP-7239
Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.
THEORETICAL CALCULATION OF THE SLOW NEUTRON SCATTERING CROSS SECTION OF ETHYLENE—MOLECULE. Report No. 54/II. J. Janik, F. Maniawski, and H. Rżany. Dec. 1958. 5p.

The scattering cross section of slow neutrons for C_2H_4 molecules as a function of neutron energy was calculated

based on the theory of Krieger and Nelkin. The theoretical curve is compared with Melkonians experimental data. In an energy interval of 0.005 to 0.07 ev a very good agreement was obtained. A discrepancy for higher energies was interpreted as an influence of inelastic neutron scattering. (auth)

5816 NRDC-58
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
THE PROMPT GAMMA PHOTONS FROM U^{235}, U^{233}, AND Pu^{239} DUE TO THE ABSORPTION OF A GLEEP NEUTRON BEAM. J. Kirkbride. Feb. 13, 1955. Decl. Jan. 26, 1959. 34p.

Two experiments are described. The first examined the gamma photons in coincidence with fission fragment pulses and gave a spectrum of prompt fission gamma photons. The second examined the gamma photons from the solid isotopes and gave spectra of prompt fission and capture photons combined. U^{233}, U^{235}, and Pu^{239} give capture gammas which are not distinguishable from fission gammas. (W.D.M.)

5817 TNCC-8
Tripartite Nuclear Cross Sections Committee.
TRIPARTITE NUCLEAR CROSS SECTIONS COMMITTEE —MINUTES OF THE TECHNICAL PORTIONS OF THE FOURTH MEETING HELD ON MAY 20-22, 1958, A.E.C.L., CHALK RIVER. Nov. 1, 1958. 27p. $1.00 (OTS).

Those parts of the complete minutes of the fourth TNCC meeting which contain technical information are presented. Cross section measurements are reported on uranium, neptunium, and plutonium isotopes, sodium-23, and fission products. (W.D.M.)

5818 UCRL-8439
California. Univ., Berkeley. Radiation Lab.
SPALLATION-FISSION COMPETITION IN NEPTUNIUM COMPOUND SYSTEMS. DECAY-SCHEME STUDIES (thesis). Richard Marshall Lessler. Oct. 1958. 76p. Contract W-7405-eng-48. $2.25(OTS).

The results of a radiochemical study of fission and spallation products induced in U^{234}, U^{235}, and U^{236} and spallation products induced in U^{238} by deuterons of less than 24 Mev are presented. The (d,n) reactions are interpreted as the result of direct interactions between the deuteron and the target nuclei, while the (d,xn) reactions are thought to be taking place primarily by compound-nucleus mechanisms. A method for predicting the peak values of the cross section for (d,xn) and (α,xn) reactions on uranium and plutonium isotopes is given for x = 2, 3, or 4. The peak-to-valley ratios of the fission-yield curves for U^{234}, U^{235}, U^{236}, and U^{238} bombarded with deuterons of energies of about 23 Mev were studied, and no significant differences were found. Excitation functions for the (d,γ) reactions of U^{234}, U^{236}, and U^{238} were measured. These excitation functions all rise to a maximum of about a millibarn at a bombarding energy between 15 and 20 Mev. The results of these measurements are seen to be consistent with the excitation functions for (p,γ) and (α,γ) reactions. The 60-minute neptunium activity which had previously been assigned to Np^{241} was identified as an isomer Np^{240}. Accompanying the decay of this Np^{240} are gamma rays of energies 1160, 1000, 915, 595, 565, 435, 245, 160, and 85 kev. Np^{241} has now tentatively been found to have isomers with half lives of 16 minutes and 3.5 hours. A study of the decay properties of the new isotope Np^{241} and also of Np^{233} and Np^{234} are described. (auth)

5819 UCRL-8547
California. Univ., Berkeley. Lawrence Radiation Lab.
HYPERFINE-STRUCTURE MEASUREMENTS ON SOME TRANSURANIC ELEMENTS. Richard Marrus. Nov. 23, 1958. 94p. Contract W-7405-eng-48. $2.25(OTS).

Hyperfine structure measurements were made on four isotopes in the transuranic region by means of the atomic beam flop-in method. These measurements yielded values of J and g_J of the low-lying electronic states of each element and values for the nuclear spin of each isotope. In addition, the hyperfine-structure splitting of Pu^{239} and the energy separations of the four observed states of Cm^{242} were determined. The spin of $\frac{1}{2}$ measured in Pu^{239} verifies earlier measurements made by optical spectroscopy and paramagnetic resonance. From the measured value of $\Delta\nu(Pu^{239})$, it was possible to infer a value for the nuclear magnetic moment of ± 0.02 nm. The electronic ground-state configurations were inferred from the J and g_J values and from detailed assumptions concerning coupling of electrons in the transuranic region. The results are in agreement with the predictions of Seaborg. A description of the theory of experiment, experimental technique, and an analysis of the results are given. (auth)

5820 UCRL-8561
California. Univ., Berkeley. Radiation Lab.
SPALLATION REACTIONS OF PLUTONIUM-240 WITH HELIUM IONS AND PLUTONIUM-242 WITH DEUTERONS (thesis). Donald L. Eads. Jan. 1959. 34p. Contract W-7405-eng-48. $1.00(OTS).

Radiochemical studies were made of the Pu^{240}(α,xn) products produced by bombarding Pu^{240} with 22- to 46-Mev helium ions. Excitation functions are given for the (α,2n)Cm^{242}, (α,3n)Cm^{241}, and (α,4n)Cm^{240} reactions. The Pu^{240}(α,xn) reactions are compared to those of the other plutonium isotopes with regard to their dependence on the fission parameter Z^2/A and their agreement with theoretical excitation functions. The latter were calculated by employing a modified Jackson-type calculation with a nuclear temperature of 1.50 Mev and an R_0 of 1.5×10^{-13} cm. The Pu(α,4n) reactions were used to evaluate the ratio of Γ_n/Γ_f for the curium isotopes. The Pu^{242}(d,2n)$Am^{242,242m}$ reactions were investigated by radiochemical methods using 11- to 24-Mev deuterons, and the excitation functions are given. (auth)

5821 WASH-1013
Nuclear Cross Sections Advisory Group, AEC.
REPORTS TO THE AEC NUCLEAR CROSS SECTIONS ADVISORY GROUP, OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENNESSEE, NOVEMBER 13-14, 1958. V. L. Sailor. 71p. $2.00(OTS).

The cross section measurement programs at ANL, BNL, Columbia Univ., HAPO, LASL, ORNL, Phillips Petroleum Co., Rensselaer Poly. Inst., Rice Inst., and UCRL are reviewed. Informal statements of recent developments, changes in emphasis, and preliminary cross section data are included. (For preceding period see WASH-1006.) (D.E.B.)

5822
GAMMA TRANSITIONS OF SOME LIGHT NUCLEI. Théo Muller. Ann phys. 3, 739-800(1958) Sept.-Oct. (In French)

As an introduction to the study of gamma transitions in light nuclei, a brief summary is given of some experimental methods used to study nuclear properties.

The apparatus used in the gamma-transition experiments is described in detail. The $Ne^{20}(d,p)Ne^{21}$ reaction was studied. The excitation curve obtained for this reaction is compatible with an excitation state of Na^{22}. This reaction allows the study of the gamma transitions of Ne^{21}. A probable spin of the second excited level of this nucleus was determined. The gamma transition of the residual O^{17} from the $F^{19}(d,\alpha)O^{17}$ reaction was investigated. A probable spin for the second excited level of this nucleus was also determined. The gamma radiations from the excitation of Mg^{25} formed by the $Mg^{24}(d,p)Mg^{25}$ reaction were studied. This nucleus, as its mirror Al^{25}, has an excitation scheme with groups of rotation bands. New results on the excitation scheme are given. (J.S.R.)

5823

PROMPT FISSION NEUTRON SPECTRA SYSTEMATIZATION. V. P. Kovalev and V. S. Stavinskii. Atomnaya Energ. 5, 649-52(1958). (In Russian)

On the basis of an evaporation model a systematic generalization is developed for previously reported experimental data, showing that neutron fission spectra for U^{233}, Pu^{239}, and Cf^{252} are harder than the fission spectrum of U^{235} and that the hardness increases from U^{233} to Cf^{252}. The analysis showed that the hardness of neutron fission spectra increases with the increase of the fissioned nucleus parameter Z^2/A. The changes in the hardness parameter β in relation to the energy of excitation is 1 to 2% for 1 Mev. The distribution of excitation energy should be determined for each fragment in order to describe simultaneously the process of neutron and γ ray emissions from fragments. (R.V.J.)

5824

AVERAGE NEUTRON NUMBER ν IN FISSION OF U^{235} AND U^{238} BY 14 Mev NEUTRONS. N. N. Flerov and V. M. Talyzin. Atomnaya Energ. 5, 653-4(1958). (In Russian)

A previously described fast neutron detector was used for measuring the magnitude of the mean number of neutrons ν in single fissions of U^{235} and U^{238} at 14 Mev. The magnitude was found by measuring the increased neutron flux. The increase of neutron number $1 + \gamma$ was measured with and without specimens. The correction coefficient considering the increased number of neutrons from fission by secondary neutrons was determined for the U^{235}. The magnitude obtained for the U^{238} where $\overline{\nu} = 4.50 \pm 0.32$ was later confirmed by other work. (R.V.J.)

5825

AVERAGE NEUTRON NUMBER $\overline{\nu}$ IN FISSION OF U^{238} BY 14 Mev NEUTRONS. N. N. Flerov and E. A. Tamanov. Atomnaya Energ. 5, 654-6(1958). (In Russian)

The average neutron number $\overline{\nu}$ in 14-Mev U^{238} fission was determined by the number of double coincidences produced by a single fission. Simultaneously, measurements were made of the neutron number from the reaction (n,2n) in lead. Thus, the mean number of secondary neutrons produced from the U^{238} fission was determined in relation to the number of neutrons from the (n,2n) reaction. The obtained magnitude $\nu = 4.45 \pm 0.35$ is in good agreement with previously reported data. (R.V.J.)

5826

CROSS SECTION OF U^{238} FISSION BY 14.6 Mev NEUTRONS. N. N. Flerov, A. A. Berezin, and I. E. Chelnokov. Atomnaya Energ. 5, 657(1958). (In Russian)

The fission cross section of U^{238} for 14.6-Mev neutrons was measured. The obtained value $\sigma = (1.13 \pm 0.05)$ barns proved to be in good agreement with previous data. (R.V.J.)

5827

MEASUREMENT OF CROSS SECTION OF (n,2n) REACTION BY 14 Mev NEUTRONS WITH Be, Pb, AND Bi. N. N. Flerov and V. M. Talyzin. Atomnaya Energ. 5, 657-9(1958). (In Russian)

The graphite prism, in a previously described fast neutron detector was used for measuring the (n,2n) reaction cross sections for beryllium, lead, and bismuth. The detector had a constant sensitivity at neutron energies 0.1 to 8 Mev and somewhat lower sensitivity to 14-Mev neutrons. The cross sections were determined in relation to the detector recording rate with and without specimens of the material studied. The total cross section for metallic beryllium specimens of 2.99 cm diameter and 0.883, 1.778, and 2.695 cm thickness was $\sigma_t = (1.42 \pm 0.02)$ barns. The (n,2n) reaction cross sections with Be, Pb, and Bi were 0.55 ± 0.06, 2.30 ± 0.19, and 2.42 ± 0.20 barns, respectively. (R.V.J.)

5828

CROSS SECTIONS OF U^{235} AND Th^{232} FISSION BY 14.6 Mev NEUTRONS. A. A. Berezin, G. A. Stol'arov, Yu. V. Nikol'skii, and I. E. Chelnokov. Atomnaya Energ. 5, 659-60(1958). (In Russian)

The cross sections of U^{235} and Th^{232} fission by 14.6-Mev neutrons were measured. The cross section of U^{235} fission was determined in relation to the U^{238} cross section. The specimens were placed intermittently into the neutron flux from a (d,t) reaction. A proportional counter recording α particles from $T(d,n)He^4$ was used as the monitor. The cross section obtained was (2.30 ± 0.15) barns. The cross section of Th^{232}, measured with an ionization chamber placed in a 14.6-Mev neutron flux, was (0.37 ± 0.02) barns. The results are in good agreement with published data. (R.V.J.)

5829

PREPARATION OF As^{74} BY CYCLOTRONS. A. I. Guldamashvili, P. P. Dmitriev, N. N. Krasnov, V. Ya. Mischin, and E. N. Khaprov. Atomnaya Energ. 5, 660 (1958). (In Russian)

Production of As^{74} by bombarding metallic germanium by a 10.8-Mev deuteron beam from a cyclotron is described. The design of the target and the diagram showing the yield of As^{74} from a thick Ge target in relation to deuteron energy are given. (R.V.J.)

5830

THE PHOTONUCLEAR REACTION $Mo^{100}(\gamma,p)Nb^{99}$. Filippo Ferrero, Alfred Olaf Hanson, Renato Malvano, and Carlo Tribuno. Atti. acad. nazl. Lincei Rend. Classe sci. fis. mat. e nat. 23, 55-7(1957) July-Aug. (In Italian)

The photonuclear reactions (γ,p) and (γ,n) in Mo^{100} were investigated at 30 Mev. The cross sections for the the reactions were 0.1 ± 0.02 and 1.5 ± 0.2 Mev-barn, respectively. The possible mechanisms are discussed. (J.S.R.)

5831

A NEW ISOTOPE OF BISMUTH. Sergio De Benedetti, Ugo Farinelli, Filippo Ferrero, Renato Malvano, Gabriele Pelli, and Carlo Tribuno. Atti. acad. nazl.

Lincei Rend. Classe sci. fis. mat. e nat. 23, 58-9(1957) July-Aug. (In Italian)

An investigation was made to determine whether the activity excited by gamma radiation of Bi^{209} could be attributed to an excited state of Bi^{208} or Bi^{209}. The excitation curve obtained is given, but no definite assignment could be made. The probability of a $Bi^{209}(\gamma,n)$ reaction was determined to be of the order of 1.5%. (J.S.R.)

5832

NUCLEAR TRANSFER REACTIONS. I. M. Demeur and A. Gribaumont (Université Libre, Brussels). Bull. classe sci. Acad. roy. Belg. 44, 472-82(1958). (In French)

A semi-classical description of nucleon transfer reactions is proposed. The wave function of the odd nucleon was established by means of the eigenfunctions of a two-minima potential. Variational trial functions for such problems are examined. The method is exemplified with the help of a particular potential. (auth)

5833

STUDY OF THE PROTONS EMITTED BY Mn^{55} AND As^{75} EXPOSED TO 14-Mev NEUTRONS. Paul Avignon and Louis Rosier. Compt. rend. 247, 1849-52(1958) Nov. 24. (In French)

The neutron reactions (n,p) in Mn^{55} and As^{75} exposed to 14-Mev neutrons were studied by a nuclear emulsion technique. The targets were prepared by electrolysis or thermal evaporation. The yield in protons was compared to that of Ni, and the total cross sections for proton emission were measured as 110 ± 15 mb for Mn^{55} and 115 ± 15 mb for As^{75}. The energy distribution of the protons is given and discussed. (J.S.R.)

5834

ELASTIC SCATTERING OF 2.8 Mev NEUTRONS BY HEAVY NUCLEI. V. I. Strizhak, I. A. Totskii, and V. V. Bobyr (Instr. of Physics, Academy of Sciences, Ukrainian SSR). Dodatok do Ukrain. Fiz. Zhur. 3, No. 1, 3-13(1958). (In Urkainian)

The cross sections of 2.8-Mev neutrons, elastically scattered by mercury, lead, and bismuth, were measured at 25 to 162°C. A spherical ionization chamber filled with methane was employed as detector. (tr-auth)

5835

FAST NEUTRON CAPTURE CROSS SECTIONS OF MAGIC AND ADJACENT NUCLEI. J. V. Hofman (Inst. of Physics, Academy of Sciences, Ukrainian SSR). Dodatok do Ukrain. Fiz. Zhur. 3, No. 1, 14-20(1958). (In Ukrainian)

The fast monoenergetic neutron capture cross sections were measured by the activation method at neutron energies of 2.5, 3.1, and 4 Mev. For standard cross sections those of I^{127} were taken from the data published and were chosen at 51, 44, and 37 millibarns respectively at the energies mentioned. The results obtained are given as atomic mass functions and are compared with other values. (tr-auth)

5836

MULTIPLE QUANTA TRANSITIONS AND MASER AMPLIFICATION IN SYSTEMS WITH TWO LEVELS. A. Javan (Columbia Univ., New York). J. phys. radium 19, 806-8(1958) Nov. (In French)

Any quantum mechanical system which permits a radiative transition between two energy levels will allow a multiple quanta transition, if, in addition, at least one of the energy levels shows a finite average of the electrical or magnetic dipole moment. This effect can be used for producing a net induced emission of microwave power in systems with a normal (positive temperature) distribution of population. The process is similar to a coherent Raman scattering phenomenon where two quanta are involved in a transition, with one of the photons being absorbed while the other is emitted. Stimulated emission at a frequency ω can thus be obtained from a two level system with energy separation $\hbar\omega_0$, when an additional radiation field is present at a frequency $\omega' = \omega_0 + \omega$, ω' being larger than ω_0. If the applied power at the frequency ω' is distributed over a frequency interval larger than the width of each level, the shape of the emission resonance will be determined by this frequency distribution. The specific case of a spin $\frac{1}{2}$ system will be treated to obtain the susceptibility at the amplified frequency and the noise figure originating from spontaneous emission. Application to maser action in ferrites, molecules, and other physical systems will be discussed. The effect can also be used for the purposes of spectroscopy and detailed study of the line shape of an optical transition by inducing a multiple quanta transition of this type in which a combination of optical and microwave photons are involved. (auth)

5837

A METHOD OF MEASURING NUCLEAR MAGNETIC MOMENTS UTILIZING THREE OSCILLATING FIELDS THE LENGTH OF AN ATOMIC JET. G. K. Woodgate and P. G. H. Sandars (Clarendon Lab., Oxford). J. phys. radium 19, 819-20(1958) Nov. (In French)

A method which renders observable the $\Delta m_J = 0$ transition in a short atomic beam apparatus is described. An atomic beam passes through three radio-frequency loops. This apparatus gives a direct measurement of nuclear magnetic moments. In practice potassium-39 was studied. (auth)

5838

DOUBLE IRRADIATION IN MAGNETIC RESONANCE BY THE IMPULSE METHOD. D. E. Kaplan and E. L. Hahn (Univ. of California, Berkeley). J. phys. radium 19, 821-5(1958) Nov. (In French)

Experiments are carried out where the free nuclear precession echoes of one spin system (A) is observed at a given frequency, while a different excitation frequency is applied to another species of nuclear spins (B) in the same sample. The (B) spin is dipole-dipole coupled to the (A) spin, and the resonance excitation of (B) is detected in terms of the change in relaxation times of the observed (A) species. Various mechanisms for induced (A)-(B) couplings are found. (auth)

5839

ELECTRONIC AND NUCLEAR DOUBLE RESONANCE MEASUREMENTS ON THE HYPERFINE STRUCTURE OF SOLIDS. B. Bleaney (Clarendon Lab., Oxford). J. phys. radium 19, 826-9(1958) Nov. (In French)

A general discussion is given of the advantages of the ENDOR (electronic and nuclear double resonance) technique for measuring hyperfine structure in paramagnetic salts, together with some of the anomalies which may be encountered. A brief account is given of the measurements of Halford, Hutchison, and Llewellyn (Chicago) on the Nd^{3+} ion in $LaCl_3$ crystals by this method. (auth)

5840

DOUBLE NUCLEAR RESONANCE IN LITHIUM FLUORIDE CRYSTALS. E. E. Schneider and K. Thompson

(Univ. of Durham, Newcastle upon Tyne, Angleteree, Eng.). J. phys. radium 19, 834-6(1958) Nov. (In French)

A simple theory is given for the effects on the resonance of a nuclear species A, in a solid sample, of a simultaneous irradiation by a strong r-f field at a frequency ω_B of another nuclear species B present in the sample in comparable abundance. This is applied to a single crystal of LiF. The experimental set up for double irradiation is described and results are given. The effect of irradiation of B on the line width of A is much smaller, and that on the spin lattice relaxation time T_1^A much larger, than predicted by the previous theory. For T_1^A a relationship is suggested between these experiments and those of Sorokin and Bloembergen on CsBr. (auth)

5841

AUGMENTATION OF NUCLEAR RESONANCE SIGNALS BY DYNAMIC POLARIZATION. I. Ionel Solomon (Centre d'Etudes Nucleaires, Saclay, France). J. phys. radium 19, 837-9(1958) Nov. (In French)

Two systems of interacting spins I and S are considered. Three cases were studied experimentally. In the first case, interaction between conduction electrons (system S) with nuclei (system I) in a semi-conductor (silicon), saturation of the electron line gives a large increase of the nuclear signal. In interaction of protons in water with paramagnetic ions of a free radical having a hyperfine structure, the second case, the enhancement of the proton signal is large enough to obtain a Maser action. For the third case, interaction of two systems of spins in a solid, irradiation at the sum or difference of resonance frequencies give an enhancement of the signal of one of the spin systems. (auth)

5842

AUGMENTATION OF NUCLEAR RESONANCE SIGNALS BY DYNAMIC POLARIZATION. II. Jean Combrisson (Centre d'Études Nucléaires, Saclay, France). J. phys. radium 19, 840-2(1958) Nov. (In French)

The enhancement of nuclear polarization obtained by saturating the resonance of electronic spins in interaction with nuclear spins gives the possibility of observing nuclear signals considerably increased and, in some cases, with a Maser action. Dipole-dipole and scalar type interaction were studied. Experimental results obtained in a low field (70 gauss) and a high field (3,000 gauss) are given. (auth)

5843

AUGMENTATION OF THE NUCLEAR POLARIZATION IN LIQUIDS AND GASES ADSORBED ON CARBON. EXTENSION TO SOLIDS CONTAINING PARAMAGNETIC IMPURITIES. J. Uebersfeld, J. L. Motchane, and E. Erb. J. phys. radium 19, 843-4(1958) Nov. (In French)

A new effect (different from the Overhauser effect) for enhancement of nuclear polarization by double resonance is described. A liquid or gas is adsorbed on carbon. Carbon contains paramagnetic centers on its surface that can interact with the nuclear spins of adsorbed liquid or gas. The proton signal is observed in the liquid (benzene or toluene) or the gas (ammoniac or hydrogen sulfide) in a magnetic field H_0 = 3,000 gauss. The nuclear resonance signal is increased without population inversion (absorption increases) when the microwave frequency $\nu_e - \nu_N$ is applied, where ν_e and ν_N are the electronic and the nuclear resonance frequencies. The nuclear resonance signal is increased with population inversion (stimulated emission) if the applied frequency is $\nu_e + \nu_N$. The same effect exists with solids since it is also obtained when the adsorbed benzene is frozen, or with solids that have been irradiated to produce paramagnetic centers. The enhancements obtained so far are of the order of 20 (with a microwave field of a fraction of a gauss) for a theoretical factor of 660 for protons, the maximum polarization attainable corresponding to the electron gyromagnetic factor. (auth)

5844

DOUBLE RESONANCE IN THE EXCITED STATE $4\ ^2P_{3/2}$ OF Na^{23}. H. Krüger and K. Scheffler (Univ. of Tübingen, Ger.). J. phys. radium 19, 854-7(1958) Nov. (In French)

The frequencies of hyperfine transitions were measured in the $4\ ^2P_{3/2}$ excited state of Na^{23} by the double resonance method. From the three transitions anticipated, the two most intense were observed at 19.6 and 9.5 MHz. According to the theoretical predictions, they are attributed to F = 3 → F = 2 and F = 2 → F = 1. The length of the ray, extrapolated for a zero amplitude of the r-f field, corresponds to 3.6 MHz. The life of the $4\ ^2P_{3/2}$ level was calculated as 0.9 ± 10^{-7} sec. In the $4\ ^2P_{3/2}$ state, the ratio of the separation of the resonances by their length is more favorable than in the $3\ ^2P_{3/2}$ state. The value of the quadrupole moment of the Na^{23} nucleus was calculated as $(0.13 \pm 0.04) \times 10^{-24}$ cm^2. (tr-auth)

5845

OPTICAL DETECTION OF NUCLEAR MAGNETIC RESONANCE OF MERCURY-201. B. Cagnac. J. phys. radium 19, 863-5(1958) Nov. (In French)

Optical pumping and optical detection were used extensively in the study of magnetic resonance of alkali metals (low and high frequency resonances). These methods were used to produce nuclear alignment of Hg^{201} in the $6\ ^1S_0$ ground state. Nuclear alignment was observed in pure Hg vapor (enriched sample containing 90% of Hg^{201}). It was illuminated with nonpolarized light coming in the direction of the static magnetic field. The light source was filled with Hg^{198} only the $^3/_2$ component of Hg^{201} is excited or with Hg^{204} (exciting the $^5/_2$ component only). At 10 Kc nuclear magnetic resonance is observed at about 35.6 gauss. The width of the observed lines (about 10 cycles) shows that collisions on the walls do not destroy orientation of mercury nuclei contrary to what is observed with alkali metals. This is the first time nuclear magnetic resonance of Hg^{201} has been observed. (auth)

5846

OPTICAL ORIENTATION OF ATOMS IN CESIUM VAPOR. Tadeusz Skalinski (l'Université de Varsovic and laboratoire de Physique de l'E. N. S., Paris). J. phys. radium 19, 890-900(1958) Nov. (In French)

A detailed study is made of low-frequency ($\Delta F = 0$, $\Delta m_F = 1$) resonance lines in Cs^{133}. This intensity is greatly increased by adding xenon at pressures ranging between 0.16 and 0.23 mm. At low r-f amplitudes the width of the $\Delta m = 2$ lines was of the order of 7.5 Kc, similar widths were observed in high-frequency transitions ($\Delta F = 1$, $\Delta m = \pm 1.0$) at 9205.3 and 9179.8 mc. They are essentially due to field inhomogeneities. (auth)

5847

GAMMA RAY SPECTROSCOPY OF Mn^{54}. Toshio Katoh, Masao Nozawa, et al. (Osaka Univ.). J. Phys. Soc. Japan 13, 1419-20(1958) Dec.

Internal conversion electrons of 0.84-Mev gamma rays were measured by a two-directional focusing beta-ray spectrometer, and it was determined that E_γ = 837.9 ± 0.3 kev and K/L + M = 8.5 ± 0.7. Weak gamma rays were searched for, using scintillation counters, but no gamma rays were observed. (auth)

5848

QUADRUPOLE MOMENT OF THE SECOND EXCITED STATE OF ^{19}F. Kenzo Sugimoto, Akira Mizobuchi, and Hisasi Yamamoto (Osaka Univ.). J. Phys. Soc. Japan 13, 1548(1958) Dec.

F^{19*} was prepared by bombarding CaF_2 targets with 1.4-Mev protons. The angular distributions of the 200-kev gamma radiations were then plotted. The quadrupole moment obtained for the excited state was $\sim 0.1_3 \times 10^{-24}$ cm^2. (D.E.B.)

5849

NUCLEAR QUADRUPOLE MOMENT OF THE RADIOACTIVE ISOTOPES Cs^{135} AND Cs^{137}. H. Bucka, H. Kopfermann, and E. W. Otten (Univ. of Heidelberg, Ger.). Naturwissenschaften 45, 620(1958). (In German)

The excited $7\ ^2P_{\frac{1}{2}}$ term of the neutral atom was investigated in Cs^{135} and Cs^{137} by the Doppler resonance method. An isotopic mixture containing 39.4% Cs^{133}, 30% Cs^{135}, and 30.6% Cs^{137} was used in the measurements. The nuclear quadrupole moments were calculated to be $Q(Cs^{135}) = +(0.049 \pm 0.01) \times 10^{-24}$ and $Q(Cs^{137}) = +(0.050 \pm 0.01) \times 10^{-24}$ cm^2. (J.S.R.)

5850

THE WIDTH OF THE 1 ev RESONANCE IN PLUTONIUM-240. B. R. Leonard, Jr., E. J. Seppi, and W. J. Friesen (General Electric Co., Richland, Wash.). Nuclear Sci. and Eng. 5, 32-5(1959) Jan.

The total neutron cross section of Pu^{240} was measured at the 1 ev resonance using a crystal spectrometer with good resolution. A detailed analysis was made of the shape of the resonance to obtain the Breit-Wigner level width parameter. The level width was determined to be (32.3 ± 1.5) mv, and the resonance energy was (1.056 ± 0.003) ev. (auth)

5851

INTERMEDIATE ENERGY NEUTRON LEAKAGE THROUGH IRON. D. E. Wood (General Electric Co., Richland, Wash.). Nuclear Sci. and Eng. 5, 45-8 (1959) Jan.

Neutron leakage through a reactor shield composed primarily of iron is discussed. This is of interest whenever the hydrogen content of a shield is reduced either by design requirements or thermal deterioration. Work done at several sites on individual aspects of the problem is combined to present an over-all description of the neutron streaming. In general there are two different phenomena involved, each determined by the geometry. In the case of a long thin streaming path, such as a structural member penetrating the shield, the leakage consists of neutrons which have suffered no collisions. These neutrons will have energies corresponding to energies at which the iron total cross section is small. Iron has several antiresonances in the interval 25 to 100 kev, with the largest dip apparently at 25 kev, so most of the neutron leakage will be at these energies. The other case involves the attenuation of neutrons by large slabs of iron with little or no hydrogen present. The 25-kev neutrons are still present, but they are augmented by a large number of neutrons of energy between thermal and 1 Mev. These neutrons may have collided elastically many times but with only a small energy loss each time. Above 1 Mev, inelastic scattering suppresses the leakage, and below a few volts, absorption removes the neutrons. (auth)

5852

COMPARISON OF THE AVERAGE NUMBER OF PROMPT NEUTRONS EMITTED IN THE FISSION OF U^{233}, U^{235}, Pu^{239}, AND Pu^{241}. G. DeSaussure and E. G. Silver (Oak Ridge National Lab., Tenn.). Nuclear Sci. and Eng. 5, 49-54(1959) Jan.

A fast coincidence technique was employed to measure the relative prompt-neutron yields per fission of U^{233}, U^{235}, Pu^{239}, and Pu^{241} induced by thermal neutrons. The values obtained were ν^{23}/ν^{25} = 1.02 ± 0.01, ν^{49}/ν^{25} = 1.23 ± 0.01, and ν^{41}/ν^{25} = 1.295 ± 0.02, where ν^{23}, ν^{25}, ν^{49}, and ν^{41} designate the prompt-neutron yields of U^{233}, U^{235}, Pu^{239}, and Pu^{241}, respectively. (auth)

5853

HALF LIVES OF N^{16}, Mg^{27}, Al^{28}, S^{37}, AND Rh^{104m_2}. J. O. Elliot and F. C. Young (U. S. Naval Research Lab., Washington). Nuclear Sci. and Eng. 5, 55-6(1959) Jan.

Scintillation detector studies were performed on the disintegration rates of five nuclides. The half lives of the nuclides are: N^{16}, (7.352 ± 0.009) sec; Mg^{27}, (9.54 ± 0.08) min; Al^{28}, (2.305 ± 0.006) min; S^{37}, (5.07 ± 0.01) min; and $Rh^{104\,m_2}$, (4.41 ± 0.02) min. (auth)

5854

EFFECTS OF TRANSLATIONAL DIFFUSION ON NUCLEAR SPIN RELAXATION IN SIMPLE CONDENSED SYSTEMS. H. C. Torrey (Rutgers Univ., New Brunswick, N. J.). Nuovo cimento (10) 9, Suppl. No. 1, 95-100(1958).

The method for finding the relaxation time for a two-phase system is reviewed and applied to systems of PdH, TaH, and TiH. Relaxation times are plotted as a function of temperature. (D.E.B.)

5855

NUCLEAR MAGNETIC RESONANCE AND MOLECULAR ASSOCIATION IN LIQUIDS. L. Giulotto (Univ. of Pavia, Italy). Nuovo cimento (10) 9, Suppl. No. 1, 101-3(1958).

According to the theory of Bloembergen, Purcell, and Pound it can be expected that in mixtures of two liquids, at different concentrations and constant temperature, the product $T_1\eta$ (T_1 = thermal relaxation time, η = viscosity) should vary linearly with concentration. If deviations from this law are observed, it is assumed that molecular association occurs. Clustering does affect the rotational motion of the molecules, causing a variation of T_1. Molecular associations in liquids and liquid mixtures can be investigated by observing, at different temperatures T and at constant concentration, possible deviations from the relationship $T_1\eta/T$ = const, which is also allowed for by the theory. The measurement of T_1 was made by a sequence of signals due to fast and adiabatic passages through resonance. T_1 is evaluated from the heights of successive signals and from the distance between them. Experimental data are reported. (A.C.)

5856

ON THE OPTICAL MODEL FOR NUCLEAR REACTIONS. L. Verlet and J. Gavoret (Laboratoire de Physique, Ecole Normale Supérieure, Paris). Nuovo cimento (10) 10, 505-19(1958) Nov. 1.

Using separable nucleon-nucleon interactions, the t-matrix is calculated. It is shown that the convergence of the perturbation series is much better for the real part of the optical potential than for the imaginary part. A study of the classical approximation is made. The validity of the classical model is tested by comparing the absorption potential obtained from the classical model in which the free nucleon-nucleon cross sections are calculated with a separable potential, with the more exact result obtained from the t-matrix calculation using the same nucleon-nucleon interaction. (W.D.M.)

5857

PRELIMINARY RESULTS ON NUCLEAR INTERACTIONS OF K^+-MESONS IN THE ENERGY REGION (240 TO 300) Mev. D. Keefe, A. Kernan, and A. Montwill (University Coll., Dublin). Nuovo cimento (10) 10, 538-40(1958) Nov. 1.

A total of 144 stars produced by K^+ mesons was found during a track scan of 72 m of heavy meson track length in an emulsion stack exposed to the separated 300-Mev K^+ beam at the Bevatron. A summary of the type of events found is shown. The measured mean free path in emulsion for nuclear interactions is 51 ± 5 cm, and the fraction of charge exchange events among the total is 0.32. No event in which a charged π meson was created was found. (W.D.M.)

5858

MESONIC DECAY OF HELIUM HYPERFRAGMENT. P. L. Jain (Univ. of Buffalo). Nuovo cimento (10) 10, 557-9(1958) Nov. 1.

An event was observed in G-5 stripped emulsions of 400-μm thickness which was interpreted as a mesonic decay of a He^4 hyperfragment. The interaction was observed in one emulsion with the exception of two particles which went into the facing emulsion. (W.D.M.)

5859

ON THE RADIATION EMITTED BY CHARGED PARTICLES INTERACTING WITH COMPLEX NUCLEI. B. Bosco (Univ. of Turin and Istituto Nazionale di Fisica Nucleare, Turin). Nuovo cimento (10) 10, 563-5 (1958) Nov. 1.

The optical model has furnished a general model to deal with inelastic scattering of particles with complex nuclei. The possibility is discussed of utilizing the optical model to evaluate the radiation emitted in these interactions. (W.D.M.)

5860

NUCLEAR RESONANCE FLUORESCENCE IN Mg^{24}. R. G. Arns, R. E. Sund, and M. L. Wiedenbeck (Univ. of Michigan, Ann Arbor). Phys. Rev. Letters 2, 50-1 (1959) Jan. 15.

A large resonance effect was observed, and preliminary measurements of the level width were made. If the emitting nucleus is assumed to be at rest before emission of the gamma cascade, it is shown that the resonance conditions for the second gamma ray can be restored by the recoil of the preceding gamma ray when the angle between the emission direction is given by $\cos\theta = -E_{\gamma 2}/E_{\gamma 1}$. In the case of Mg^{24}, $E_{\gamma 1}$ = 2.76 Mev, $E_{\gamma 2}$ = 1.38 Mev, it is possible to observe resonant scattering of the 1.38-Mev gamma when the angle between it and the 2.76-Mev gamma is about 120°. (W.D.M.)

5861

POLARIZED NUCLEONS FROM THE PHOTODISINTEGRATION OF THE DEUTERON. J. J. de Swart (Univ. of Rochester, N. Y.); W. Czyz (Univ. of Copenhagen); and J. Sawicki (Princeton Univ., N. J.). Phys. Rev. Letters 2, 51-3(1959) Jan. 15.

The polarization of nucleons from photodisintegration of the deuteron was studied under the same assumptions used by DeSwart and Marshak in an extension of the two-nucleon potential of Signell and Marshak in which it was shown that agreement with the experimental data in the medium energy range could be obtained without renouncing the Siegert theorem by assuming as the final state interaction the Signell-Marshak potential and assuming for the deuteron about 7% D-state probability. (W.D.M.)

5862

POSSIBLE EXPLANATION OF HYPERFRAGMENT SUPPRESSION IN K^--d REACTIONS. T. B. Day (Univ. of Maryland, College Park) and G. A. Snow (Univ. of Maryland, College Park and U. S. Naval Research Lab., Washington). Phys. Rev. Letters 2, 59-61(1959) Jan. 15.

One of the reactions that can occur when a K^- meson is captured from an atomic orbit about a deuteron is $K^- + d \rightarrow \Sigma^- + n + \pi^+$. It is shown that the probability of the formation of the (Σ^-, n) bound state via the s-wave capture process from the 2P orbit is one order of magnitude smaller than for the processes considered by Pais and Treiman. (W.D.M.)

5863

DECAY OF Ta^{180}. II. P. Eberhardt, P. Signer, et al. (Univ. of Bern and Max-Planck-Institut für Chemie, Mainz). Z. Naturforsch. 13a, 1004(1958) Nov. (In German)

In order to estimate the decay constant for the K capture of Ta^{180} by the detection of Hf^{180}, the hafnium content of a tantalite mineral, previously investigated to determine the beta decay (Z. Naturforsch. 10a, 796 (1955)), was determined. From the analytical data and the known age of the tantalite mineral, the decay constant for the K capture of Ta^{180} was determined with $\lambda_K = 1.5 \times 10^{-10}\ yr^{-1}$ as the upper limit. (J.S.R.)

5864

THE ANGULAR DISTRIBUTION IN THE PHOTOFISSION OF THORIUM. H. Faissner and F. Gönnenwein (Univ. of Tübingen, Ger.). Z. Physik 153, 257-68 (1958). (In German)

Nuclear emulsions impregnated with thorium nitrate solution were exposed to the 15.8-Mev bremsstrahlung of the Tübingen betatron. Fission tracks were identified by ionization and range, and their angular distribution relative to the incoming γ rays was measured. As the origin of fission was unknown, the distributions obtained extend from 0° to 90° only. All tracks with a dip angle less than 50° were accepted, giving a total of 1726 events. The preponderance of fragment emission under 90° is pronounced even in the distribution of projected angles. After some calculation and correction, the distribution of true, spatial angles could be obtained from the data. Although a three-constant formula gave the best fit to the distribution observed, the quadrupole term was found not to be statistically significant. It was concluded that the angular distribution is a pure dipole form with an anisotropy $\alpha = 0.55 \pm 0.12$. This is in agreement with previous counter experiments. The anisotropy is interpreted in terms of the Bohr model, some of the implications of which are discussed. Extension of the measurements to 180° might be feasible

by utilizing the ionization properties of fission tracks near the origin. (auth)

5865

YIELD OF THE $Ni^{60}(d,2n)Cu^{60}$ REACTION. R. Radicella, J. Rodriguez, et al. (Comisión Nacional de la Energia Atómica, Buenos Aires). Z. Physik 153, 314-16(1958). (In German)

The total effective cross section for the $Ni^{60}(d,2n)Cu^{60}$ reaction was determined in the range from 9.0 to 27.4 Mev. The saturation activity of Cu^{60} was compared with that of Na^{24} which has a known effective cross section for this irradiation. The results were discussed with respect to the reaction mechanism. Approximate agreement was obtained on the basis of deuteron stripping. (tr-auth)

5866

THE SPECTRUM OF IRIDIUM. STRUCTURE, ZEEMAN EFFECT, AND CONFIGURATION CALCULATIONS. Theodorus Antonius Maria Van Kleef. Thesis, University of Amsterdam, 1957. (In Dutch)

The results of investigation on the Zeeman effect and the configuration calculations in the spectrum of Ir(I) are reported. A survey is first given of the studies of the arc spectra of the elements in the 5d group during the last ten years. The apparatus used to investigate the Zeeman effect and the spectrum is described. The spectrum of Ir (I) is analyzed. The configuration calculations in the low even group are given. (J.S.R.)

5867

THE USE OF THE PROPORTIONAL COUNTER FOR NUCLEAR MEASUREMENTS. COINCIDENCE MEASUREMENTS ON THE DECAY OF THALLIUM 202. Henricus Cornelis Hamers. s'Gravenhage, Netherlands, Uitgeverij Excelsior, [1958]. 87p.

Various investigations on proportional counters are described. Components and circuits for the counters were investigated and are described. The electron capture decay of Tl^{202} was studied as an application of the experimental arrangements. Single and coincidence measurements were carried out. (W.D.M.)

5868

INTERNAL CONVERSION COEFFICIENTS. M. E. Rose. New York, Interscience Publishers Inc., 1958. 192p.

A comprehensive account of the ten year program devoted to the calculation of internal conversion coefficients is presented. This program falls quite naturally into three parts in each of which a separate and essentially independent set of numerical results was obtained. The theoretical basis for the numerical results is described. (W.D.M.)

Theory

5869 A/CONF.15/P/2459

Columbia Univ., New York.

WEAK INTERACTIONS. C. S. Wu and L. Lederman. 30p. $0.50(OTS).

Prepared for the Second U. N. International Conference on the Peaceful Uses of Atomic Energy, 1958.

A brief account is presented of the developments in weak interactions since the theory of non-conservation of parity was proposed. 25 references. (J.S.R.)

5870 KAPL-M-JS-5

Knolls Atomic Power Lab., Schenectady, N. Y.

HOMOGENIZATION OF SLAB LATTICES. John C. Stewart. Jan. 6, 1959. 14p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

An approximate expression giving the flux ratio in repeating moderator-absorber slab arrays to within 3% over the whole range of parameters is presented, and its employment in self-shielding problems is described. Limiting cases drawn from various transport theory calculations are indicated. (auth)

5871 AEC-tr-3540

DISPERSION RELATION FOR PROCESS $\pi + N \rightarrow \pi' + \pi'' + N'$ IN APPROXIMATION OF A QUIESCENT NUCLEON. (Dispersionnoye Sootnosheniye Dlia Protsessa $\pi + N \rightarrow \pi' + \pi'' + N'$v Priblizhenii Pokoyashchegosia Nuklona.) V. Tsellner, O. Khrustalev, V. Serebriakov, and A. Leznov. Translated by Lydia Venters (Argonne National Lab.) from a Publication of the Joint Inst. of Nuclear Research. Lab. of Theoretical Physics, Moscow, 1958. 14p. $0.50(OTS).

With the help of a scheme developed by N. N. Bogoliubov, a dispersion relation was established for the process $\pi + N \rightarrow \pi' + \pi'' + N'$ in approximation of a quiescent nucleon. A considerable part of the unobservable region is covered by a continuous spectrum, whose approximate calculation leads to an integral equation between Hermitian and non-Hermitian parts of amplitude of process. From the obtained dispersion relation an equation is derived of the Chu-Loy type, satisfying all requirements of symmetry. (auth)

5872

STATISTICAL DERIVATION OF THE DISPERSION FORMULA OF A LORENTZ PLASMA OF FINITE TEMPERATURE. K. Rawer and K. Suchy (Univ. of Marburg, Lahn, Ger.). Ann Physik 2, 313-25(1958). (In German)

A graduated term in the Boltzmann equation of the electron, neglected till now, was used to obtain a dispersion equation for three propagation patterns ("primary polarization"). The temperature was characterized by a parameter which contains the adiabatic polytropic exponents. This appears in the statistical derivation naturally, but it must be introduced in the derivation from the macroscopic pulse balance by an additional adiabatic postulate. (tr-auth)

5873

SPHERICAL VORTEX IN MAGNETO-HYDRODYNAMICS. Cataldo Agostinelli. Atti. acad. nazl. Lincei Rend. Classe sci. fiz. mat. e nat. 24, 35-42(1958) Jan. (In Italian)

The possible formation of a spherical vortex in a perfect electroconducting fluid from the generation of a magnetic field is studied. It is shown that if the fluid has infinite conductivity and is subject to a uniform magnetic field with fixed direction, the formation of a spherical vortex, symmetric with respect to the direction of the magnetic field, is possible. The kinetic characteristics of the vortex coincide with those of the Hill vortex. The center of the vortex moves with a uniform linear motion according to the axis of the imposed magnetic field. It generates, in its turn, a magnetic field whose components appear continuously through the spherical surface of the vortex. At infinity the velocity approaches zero, the pressure tends toward a finite value, and the magnetic field nears a constant value. (J.S.R.)

5874

PROPAGATION OF PLANE ELECTROMAGNETIC

WAVES IN UNIDIRECTIONAL CONDUCTOR WITH VARIABLE DIRECTION OF CONDUCTIVITY. Carlo Banfi. Atti. acad. nazl. Lincei Rend. Classe sci. fiz. mat. e nat. 24, 306-10(1958) Mar. (In Italian)

The propagation of a wave crossing a succession of unidirectional screens, one rotating at the same angle with respect to the other, is studied. To treat the problem analytically in a simple manner, a medium with anisotropic conductivity and isotropic permeability is considered. (J.S.R.)

5875

REFLECTION AND REFRACTION IN MAGNETO-HYDRODYNAMICS. Carmelo Totaro. Atti. acad. nazl. Lincei Rend. Classe sci. fiz. mat. e nat. 24, 310-16(1958) Mar. (In Italian)

The reflection and refraction of hydromagnetic waves at the interface between two liquids of finite conductivity are studied. The investigation is based on the Eulero-Minkowski system, and the propagation of the wave in a different direction from that of the external magnetic field is considered. (J.S.R.)

5876

ELLIPSOIDAL EQUILIBRIUM SHAPE FOR AN ELECTRICALLY CONDUCTING FLUID MASS ROTATING UNIFORMLY WITH A MAGNETIC FIELD VARYING WITH TIME. Cataldo Agostinelli. Atti. acad. nazl. Lincei Rend. Classe sci. fis. mat. e nat. 23, 409-14 (1957) Dec. (In Italian)

The ellipsoidal shape of an incompressible fluid mass, electrically conductive, uniformly rotating, and subject to gravitational laws in which is generated a magnetic field dependent on time, was investigated. It is shown that the components of the magnetic field vary linearly with the coördinate of the point in the center of mass and periodically with respect to time. The periods are equal to those of the rotation of the fluid mass. (J.S.R.)

5877

THE IDEA OF SPIN IN THE RELATIVISTIC HYDRODYNAMICS OF FLUID MASSES IN ROTATION. Maurice Kléman. Compt. rend. 247, 1831-3(1958) Nov. 24. (In French)

A definition of spin in relativistic hydrodynamics is proposed. A generalization is made on a particular case of the classic theorem of equal projectivity of the velocities on solid bodies. (tr-auth)

5878

CONDITIONS ON SHARP DISCONTINUITY SURFACES IN THE GENERAL RELATIVITY THEORY. V. A. Skripkin (Steklov Inst. of Math., Academy of Sciences USSR). Doklady Akad. Nauk S.S.S.R. 123, 799-802 (1958) Dec. 11. (In Russian)

Conditions are derived for shock waves in an ideally compressed medium in general relativity theory. For a centrally-symmetric field the components of the 4-dimension metric tensor are continuous but their derivatives are discontinuous in transition through the impact wave. Conditions are developed for the general case of first and second derivatives of the metric tensor of impact waves. (R.V.J.)

5879

RESONANCE ESCAPE PROBABILITY IN HYDROGENOUS LATTICES. W. W. Clendenin (Westinghouse Electric Corp., Pittsburgh). Nuclear Science and Eng. 5, 1-4(1959) Jan.

A series expansion method is used to obtain approximate solutions to the velocity-dependent transport equation near a resonant energy. Numerical examples of typical cases are given. (auth)

5880

PERTURBATION THEORY OF CONTROL ELEMENTS. II. Bertram Wolfe and David L. Fischer (General Electric Co., San Jose, Calif.). Nuclear Sci. and Eng. 5, 5-10(1959) Jan.

A two-group second-order perturbation expression for control element worth is obtained. This has, as its starting point, the unperturbed fast flux but considers the depression in the thermal flux caused by the control element and then, in turn, considers the perturbation on the fast flux caused by the perturbed thermal flux. Finally, the effect of the perturbed fast flux on the thermal flux is evaluated. It is shown that this process, if continued, converges to the correct answer. The perturbation results are compared to experiments for the case of a weak rod in the reflector region of the Bulk Shielding Reactor. The perturbation results are also compared to exact two-group calculations for a cylindrical rod on the axis of a bare cylindrical reactor. In both cases, excellent agreement is obtained. (auth)

5881

THEORY OF PULSED NEUTRON EXPERIMENTS IN MULTIPLYING MEDIA. T. J. Krieger and P. F. Zweifel (Knolls Atomic Power Lab., Schenectady, N. Y.). Nuclear Sci. and Eng. 5, 21-7(1959) Jan.

The spatial and temporal distribution of thermal neutrons in a multiplying assembly following the introduction of a short burst of fast neutrons is investigated by means of an extension of the so-called "asymptotic reactor theory" to the time-dependent case. It is shown that the solution for an nth mode fast neutron source can be reduced to that for an nth mode thermal neutron source, so that only the latter need be considered. A formal solution to the time-dependent thermal diffusion equation with an nth mode thermal source is found for an arbitrary slowing-down kernel. The asymptotic behavior of the flux in the long-time limit is shown to be exponential, with a decay constant satisfying a generalized material buckling equation. The asymptotic behavior following a burst of fast neutrons is also found to be exponential with the same time constant. In a continuous slowing-down model, all neutrons slow down in the same time, implying that the time-dependent part of the time-dependent slowing-down kernel is a Dirac delta-function. In this case, an explicit expression for the flux following a burst can be derived, from which the approach to the asymptotic behavior is clearly seen. The mean slowing-down time (t) is used to find an approximate expression for the asymptotic decay constant. To evaluate (t) for hydrogenous media, it is noted that the Laplace transform of the Boltzmann equation is identical with the time-independent Boltzmann equation if, in the latter, $\Sigma_a(E)$ is replaced by $\Sigma_a(E) + \eta/\nu(E)$, where $\nu(E)$ is the neutron velocity and η the Laplace transform variable. The resulting equation can then be solved by standard methods. The infinite medium ($B^2 = 0$) result of 0.92 μsec for the slowing-down time to 1.4 ev is in good agreement with the value 0.85 μsec obtained from Monte Carlo calculations. The validity and application of the method are discussed. (auth)

5882

γ_5-INVARIANCE AND STRONG INTERACTIONS.

Berthold Stech (Univ. of Heidelberg, Ger.). Phys. Rev. Letters 2, 63-4(1959) Jan. 15.

There is much evidence that the weak interactions possess a typical invariance, which is called the γ_5 invariance or chirality invariance. The interaction Hamiltonian for weak interactions is invariant under the transformation $\psi \rightarrow \gamma_5 \psi$ for each spinor particle involved. The possibility of extending the γ_5 invariance to strong interactions is discussed. (W.D.M.)

5883

ON THE ORIGIN OF COSMIC RAYS DURING THE EARLY PART OF THE EVOLUTION OF OUR GALAXY. L. Biermann and L. Davis (Max-Planck-Institut für Physik, Göttingen, Ger.). Z. Naturforsch. 13a. 909-15 (1958) Nov.

The hypothesis is considered that the volume in which the cosmic rays are stored is comparable to that of the halo of our system and hence (if the total amount of gas in the halo is at most comparable with that in the disk) the average cosmic-ray life time is comparable with the age of the galaxy. Reasons are given which indicate that the amount of interstellar gas, the number of early type stars, and the rate of production of cosmic rays were much greater in the early part of the evolution of our galaxy than they are now. It is shown that under these conditions the observed data on the cosmic-ray isotropy, including that of the very high energy component, and the data on the abundance of the Li, Be, and B nuclei may be understood, and that, in addition, the conditions for the statistical (Fermi type) mechanisms of acceleration to be operative were much more favorable in the early stages than they are now. (auth)

5884

THE STRUCTURE OF HYDROMAGNETIC SHOCK WAVES. I. NON LINEAR HYDROMAGNETIC WAVES IN A COLD PLASMA. L. Davis, R. Lüst, and A. Schlüter (Max-Planck-Institut für Physik, Göttingen, Ger.). Z. Naturforsch. 13a, 916-36(1958) Nov.

The waves in a cold (no thermal motions) quasi-neutral gas consisting of ions and electrons are treated neglecting collisions but not neglecting the inertial effects associated with the electric current. Provided the particle trajectories do not make loops, the non-linear equations for infinite plane compressional waves traveling perpendicular to a uniform magnetic field with unchanging form and speed are reduced to a single second-order ordinary differential equation in the field strength (or the particle displacement normal to the direction of propagation) and solved exactly. The solutions can be expressed in terms of elliptic functions. Curves derived from numerical integration by means of a digital computer give the important properties of the waves. Power series solutions in the amplitude, a, are given, the error being of the order of a^4. Both wave trains and solitary waves are found, all solutions being symmetrical about maxima and minima in the field strength. The wavelengths are of the order of the gyro-radius. The velocities range from zero to twice the Alfvén velocity, higher velocities leading to looped trajectories. By reduction to dimensionless form, all waves are included in a two parameter family. The relation of these waves to hydromagnetic shock waves in low density plasmas is considered and it is concluded that the entire shock will have a thickness determined by the product of the mean time between collisions and the gas velocity with respect to the shock front. This region will be occupied by wave trains whose structure is of the order of the gyro-radius. Two analogues of the Rankine-Hugeniot conditions are given, one in which the regions on the two sides of the "shock-front" are occupied by cold plasmas containing different wave trains, the other being the familiar hydromagnetic shock conditions except that only particle motions normal to the magnetic field are considered. In each all conservation laws are satisfied across the "shock-front" but there seems to be no satisfactory mechanism for the processes within the front. (auth)

RADIATION EFFECTS ON MATERIALS

5885 A/CONF.15/P/1862

[Knolls Atomic Power Lab., Schenectady, N. Y.] RADIATION STABILITY OF CORE COMPONENTS CONTAINING THE FISSILE ATOMS U^{235} AND B^{10}. C. E. Weber. 5p. $0.50(OTS).

Prepared for the Second U. N. International Conference on the Peaceful Uses of Atomic Energy, 1958.

The radiation stability of UO_2 dispersion fuel elements is presented. (W.L.H.)

5886 A/CONF.15/P/2508

Westinghouse Electric Corp. Bettis Plant, Pittsburgh. REQUIREMENTS AND TECHNIQUES FOR IRRADIATION TESTING OF REACTOR MATERIALS FOR PRESSURIZED WATER REACTORS. P. Cohen and D. M. Wroughton. 83p. $0.50(OTS).

Prepared for the Second U. N. International Conference on the Peaceful Uses of Atomic Energy, 1958.

The problems of engineering tests of reactor materials and fuels are examined and illustrated in terms of the needs for and experience encountered in the development of the cores for pressurized-water reactors. The adaptation of facilities and test conditions to available test reactors is described along with the design problems of loops. The utilization of irradiation testing is illustrated by a brief discussion of the program and results for the development of uranium oxide fuel for use in the Shippingport Pressurized Water Reactor. (auth)

5887 AD-149986

Olin Mathieson Chemical Corp., New Haven. TESTING PROGRAM FOR IRRADIATED PACKAGING FILMS. Final Report No. 5. Period Covered: September 26, 1956—June 25, 1957. K. W. Ninnemann. Sept. 26, 1956. 31p. Project No. 7-84-01-002. Contract DA19-129-qm-761.

Results are summarized from a series of tests for determining the effects of irradiation on the physical characteristics of polymer-coated 300 OX-511 cellophane. A review of the test data obtained immediately after irradiation of the film and at intervals of 1, 3, and 6 months thereafter indicated that some degradation of permeability and strength characteristics occurred initially as a result of irradiation. As the storage period at 15%, 35%, and 81% relative humidity lengthened, there were no increasing effects which could be attributable to the irradiation. The tests further showed that strength characteristics of the samples subjected to the greatest irradiation dosage of 5 million rep were degraded to a degree which may be sufficient to decrease the effectiveness of this cellophane in certain packaging applications. Samples stored at 35% relative humidity and thus maintained at their normal moisture content showed the effects of irradiation least. (auth)

5888 AD-157539
Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
GAMMA IRRADIATION OF GERMANIUM P-N JUNCTION DIODES (thesis). Clarence N. Munson. Mar. 1958. 41p.

In order to determine the effects, permanent and temporary, of gamma radiation on the reverse current characteristics of germanium p-n junction diodes, Western Electric 1784 and 1786 Varistors were first given various surface treatments and then exposed to gamma radiation from a cobalt-60 source. The source strength was 3.35×10^5 roentgens per hour, and the diodes were irradiated for various periods of time. To provide comparisons of reverse current, measurements were made before, during, and after various periods of radiation. The results indicate that the cumulative or permanent effects are due to lattice defects in the bulk of the germanium resulting in a change of the Fermi level. The temporary effects existing while the germanium is being irradiated and for a short time afterward are due to changes in surface states, minority carrier densities, acceptor and donor levels, and recombination times due to radiation damage. In general the cumulative effects were the over-all increase in reverse current due to radiation-induced lattice defects which did not anneal out at room temperatures. The temporary effects were results of changes in the surface condition caused by photogeneration and disappeared due to a combination of effects. It is thought that these effects are recombination of minority charge carriers, heating effect due to current flow, and the electric field effect on the n-type surface states. (auth)

5889 AFOSR-TN-58-1096
Turin. Istituto Elettrotecnico Nazionale Galileo Ferraris.
EFFECT OF NEUTRON BOMBARDMENT ON THE MAGNETIC PROPERTIES OF IRON. Technical Note 1 b. Giuseppe Biorci, Guido Bonfiglioli, Andrea Ferro, and Giorgio Montalenti. Sept. 1958. 49p. Contract AF61(514)-1331. (AD-207597).

Results suggest that, in metals, neutron bombardment produces weak internal stresses besides other defects, which fluctuate from point to point with an average period of the order of the domain size (20 μ). These internal strains are possibly associated with the production of thermal spikes during irradiation and hence can contribute to confirm their existence. The observed effects on magnetic properties might be due, at least in part, to slight aging effects that may occur during irradiation. Hence it should be useful to confirm the results on extremely pure materials. On the same specimens have been made also some x-ray measurements, no change in lattice parameter and no widening of the Debye diffraction lines have been observed. Measurements of mechanical properties show remarkable variations, in agreement with the literature. The results on magnetic properties confirming that the internal stresses introduced by irradiation are very weak, further support the hypothesis that the increase in strength of irradiated metals is mainly due to some mechanism of anchoring of the dislocations by the point defects produced during the irradiation itself. (auth)

5890 NP-7095
Battelle Memorial Inst. Radiation Effects Information Center, Columbus, Ohio.
EFFECT OF NUCLEAR RADIATION ON ELECTRONIC TRANSFORMERS AND TRANSFORMER MATERIALS. Technical Memorandum No. 7. J. F. Hansen. Nov. 30, 1958. 5p. Project No. 2133. Contract AF33(616)-5171.

Various types of transformers, including power, filament, audio, intermediate frequency, and pulse, and r-f chokes were exposed to a fast neutron flux of 1.1×10^{14} fast neutrons/cm^2 and a gamma dose of 4.2×10^8 ergs/g(C). Coil resistances were measured in these tests, as were output voltages under normal conditions of input voltages and load. The measurements indicated very little damage after exposure, and no conclusive damage patterns could be detected. (J.R.D.)

5891 NP-7096
Battelle Memorial Inst. Radiation Effects Information Center, Columbus, Ohio.
THE EFFECT OF NUCLEAR RADIATION ON SEALS, GASKETS, AND SEALANTS. Technical Memorandum No. 8. N. J. Broadway and S. Palinchak. Nov. 30, 1958. 11p. Project No. 2133. Contract AF33(616)-5171.

Nitrile, neoprene, and Thiokol rubbers were irradiated as gaskets, seals, or sealants for operation below 300°F. Thiokol was evaluated in JP-4 fuel as a sealant and found to perform satisfactorily to a dosage of 3.5×10^9 ergs/g(C). Nitrile and neoprene were evaluated only in air and found to be resistant to 1×10^{10} and 1×10^9 ergs/g(C), respectively. For operation above 300°F, fluorocarbon elastomers and a number of silicone materials were evaluated. In the nonelastomer class Teflon was irradiated as a seal. Viton A and Elastomer 214 softened in air at 6×10^8 ergs/g(C) with retention of rubber-like properties. A dimethyl silastic O-ring retained flexibility in a vacuum seal at a dosage of 2×10^{11} ergs/g(C), while the Silastic 50-24-480, used in an oil seal for 48 to 50 hours at 450°F, withstood a radiation dosage of 1.2×10^9 ergs/g(C). (J.R.D.)

5892 NP-7099
Battelle Memorial Inst. Radiation Effects Information Center, Columbus, Ohio.
THE EFFECT OF NUCLEAR RADIATION ON HYDROCARBON FUELS. Technical Memorandum No. 11. L. J. Hillenbrand. Nov. 30, 1958. 13p. Project No. 2133. Contract AF33(616)-5171.

A summary of the information available at REIC on the radiation stability of hydrocarbon fuels is presented. The post-irradiation performance is discussed as well as performance during in-source testing. In addition, Air Force projects devoted to the study of the radiation stability of fuels are listed to indicate the scope of the work which has been done. The diverse ways in which complex mixtures such as jet fuels respond to radiation are considered, and it is pointed out that pre-irradiation and irradiation during performance apparently do not produce effects that can be related to each other. (J.R.D.)

5893 NP-7189
Illinois Inst. of Tech., Chicago. Armour Research Foundation.
IRRADIATION TESTING OF OPERATING ELECTRONIC EQUIPMENT BY FAST NEUTRONS AND GAMMAS. Final Report. R. J. Arndt and C. W. Terrell. Apr. 30, 1958. 42p. ARF Project No. A-106. Contract N62269-253.

A study of the radiation effects of fast neutrons (0.5 ev to about 15 Mev) and gamma rays (fission spectrum) on various pieces of aircraft instrumentation is re-

ported. Components studied were: fuel gage vacuum-tube amplifier and indicator, transistorized (germanium and silicon) servo amplifier system, and 4-in. diam. gyro. The fuel gage was subjected to a total neutron flux of about 6×10^5 nvt and about 5×10^5 r gamma with no adverse electrical effect. Physical damage was evident. Four transistorized amplifiers were irradiated in a fast flux of about 1.0×10^{10} n/cm^2/sec. Rapid loss in gain, rapid increase in d-c current drain, and complete failure occurred when the integrated flux reached about 10^{13} n/cm^2. The silicon diodes were unaffected by the same flux. Studies on the gyro were inconclusive due to equipment failure. (auth)

5894 WADC-TR-58-325
New York Univ., New York. Coll. of Engineering.
A LITERATURE SURVEY ON THE RELATIONSHIP BETWEEN DIMENSIONAL CHANGES PRODUCED BY RADIATION AND CRYSTAL STRUCTURE. [Period covered:] October 1956 to October 1957. Irving B. Cadoff. June 1958. 18p. Project title: SOLID STATE RESEARCH AND PROPERTIES OF MATTER. Task title: EFFECT OF ENVIRONMENT OF THE INTERNAL STRUCTURE OF SOLIDS. Contract AF33(616)-3868. (AD-155665).

The results of a survey of the literature dealing with nuclear irradiation effects in structural material indicate that dimensional instability due to lattice displacements should not be a significant effect. These results indicate, however, that induced transmutations may cause dimensional change. In the case of lattice displacements, there appears to be a correlation between growth anisotropy and crystal structure anisotropy. (auth)

5895 YAEC-93
Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.
CORROSION PRODUCT TRANSPORT AND DEPOSITION UNDER IONIZING RADIATION. C. C. Thomas, Jr. and H. W. Lacock—H. Y. Cadoff, ed. Dec. 1958. 34p. For Yankee Atomic Electric Co. Contract AT(30-3)-222, Subcontract No. 1. $6.30(ph OTS); $3.00(mf OTS).

A study was made of corrosion product transport and deposition on Zircaloy-2 and AISI 304 stainless steel in the presence and absence of ionizing radiation. Three 100-hour irradiation tests, using 2-Mev electrons from a Van de Graaff accelerator, and four 100-hour nonradiation tests were performed in 600°F pressurized water. Data from the seven runs and an additional exploratory run are presented. In addition, complete experimental procedures and descriptions of the apparatus are included. Control of pH was obtained by using H and OH form ion exchange resins for pH 7 and Li and OH form ion exchange resins for pH 10. The major conclusion to be drawn from the present work is that the deposition on Zircaloy-2 at pH 10 and 600°F is higher than on AISI 304 stainless steel at the same conditions. (auth)

5896
EFFECTS OF HIGH ENERGY RADIATION ON POLYMERS. II. END-LINKING AND GEL FRACTION. Osamu Saito (Chuo Univ., Tokyo). J. Phys. Soc. Japan 13, 1451-64(1958) Dec.

The effect of end-linking induced in polymers by high-energy radiation is discussed. When cyclization does not occur, the same results are obtained as those derived by A. Charlesby, and, moreover, it is known that for any initial distribution the gel formation does not occur when σ is smaller than $\frac{1}{4}$, where σ represents the probability that an end produced by a molecular scission links with a monomer unit of another molecule. The theory also gives the average molecular weights and the average end numbers. For the initial uniform distribution the weight average molecular weight has a maximum in case $\frac{1}{12} < \sigma < \frac{1}{4}$, while for the initial Poisson distribution it has no maximum. The weight average and number becomes infinite at the gel point, but the number average end number does not. It is shown that the retardation of incipient gel formation is negligible when cyclization occurs. Beyond the gel point the gel part grows rapidly. The feature is studied in the cases of cross-linking and end-linking with or without cyclization, and it is shown that the gel fraction is smaller by several per cent in the case with cyclization than in the case without cyclization. (auth)

5897
EFFECTS OF HIGH ENERGY RADIATION ON POLYMERS. III. VISCOSITY. Osamu Saito (Chuo Univ., Tokyo). J. Phys. Soc. Japan 13, 1465-76(1958) Dec.

It was known that solubility of irradiated polymers was not free from the effect of cyclization. On the contrary, viscosity before the gel point is not affected by it and it is utilized in order to investigate the effects of high-energy radiation on polymers. Intrinsic viscosity is discussed first for the case where cross-linking and degradation occur. In certain cases intrinsic viscosity decreases in the initial period of irradiation, but increases in larger radiation doses, so that it has a minimum and becomes infinite at a certain radiation dose which corresponds to gel point. It is also derived that G values of cross-linking and degradation are calculated from the intrinsic viscosity in the initial period of irradiation. An example of polyvinylchloride gives G values whose orders of magnitude are not unreasonable. The more accurate the measurement, the more correct values will be obtained. Intrinsic viscosity for the case where end-linking occurs is likewise discussed, and the same properties as those in cross-linking are derived. Finally, the gel point determined from an asymptotic behavior of intrinsic viscosity will be more correct than that determined from an extrapolation of the solubility curve. (auth)

5898
NMR STUDY OF γ RAY INDUCED POLYMERISATION OF ETHYL ACRYLATE. Toshikazu Shibata, Itsuro Kimura, and Tokuo Suita (Osaka Univ.). J. Phys. Soc. Japan 13, 1546-7(1958) Dec.

Experimental results from proton magnetic resonance absorption studies of ethyl acrylate during polymerization are reported. A 100 c cobalt-60 source was used in irradiations up to 2×10^5 r/hr. Resonance patterns varied with increasing γ doses due to viscosity changes with polymerization. (A.C.)

RADIOACTIVE WASTE

5899 KAPL-M-SMS-95
Knolls Atomic Power Lab., Schenectady, N. Y.
DECONTAMINATION OF THE KAPL 120 LOOP BY ALKALINE PERMANGANATE–ACID TREATMENTS. F. C. Steiner. Nov. 24, 1958. 66p. Contract W-31-109-Eng-52. $10.80(ph OTS); $3.90(mf OTS).

Failure of a Bettis fuel element in the KAPL-120 loop resulted in extensive radioactive contamination of the facility. The operation and results of the two decontaminations are summarized. (W.L.H.)

REACTORS

General

5900 A/CONF.15/P/1900
Division of Reactor Development, AEC.
THEORY AND APPLICATION OF BURNABLE POISONS. A. Radkowsky. 59p. $0.50(OTS).

Prepared for the Second U. N. International Conference on the Peaceful Uses of Atomic Energy, 1958.

The physics aspects of the use of burnable poisons in various applications as extension of reactor endurance, improved core performance through better flux factors, and reduced mechanical control and improved temperature coefficient of reactivity are presented. (W.L.H.)

5901 AERE-R/M-217
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
FLUX AND SHIELDING MEASUREMENTS IN A SOURCE REACTOR MOCK-UP. H. R. McK. Hyder, I. F. Y. MacKenzie, A. L. Pope, and G. A. Price. Nov. 1958. 13p.

A pool-type reactor proposal for irradiating exponential and fine structure stacks of graphite and uranium was investigated. Power requirements and shielding necessary for this reactor were measured by erecting a graphite–U lattice at experimental panel B of LIDO. (T.R.H.)

5902 ARF-D132D11-1
Illinois Inst. of Tech., Chicago. Armour Research Foundation.
STUDIES OF REACTOR CONTAINMENT. TASK NO. 6 [ON] EXPLOSIVES TEST EVALUATION OF BLAST SHIELDS FOR NUCLEAR REACTORS. REPORT NO. 1. A TECHNIQUE FOR THE OBSERVATION AND MEASUREMENT OF THE BEHAVIOR OF POROUS MATERIALS WHEN RAPIDLY COMPRESSED. H. S. Napadensky, J. Pinsky, and R. Stresau. Aug. 1958. 35p. Contract AT(11-1)-528. $1.00(OTS).

The technique described may be used to obtain data regarding the behavior of porous media when they are rapidly compressed. Data which can be obtained include relationships between stress and strain under dynamic conditions, coefficients of restitution, compression wave velocities, decay rates and wave form modifications. Although there is still room for improvement and refinement, the present technique can be used to produce data needed by, and not previously available to, designers of blast shields and similar structures. The data presented herein are preliminary, included mainly to illustrate the usefulness of the technique. It may be noted, however, that they leave little room for doubt regarding the value of porous materials in the absorption of shock energy. The coefficients of restitution are velocity ratios. Since the kinetic energy varies as the square of the velocity, between 90 per cent and 96 per cent of the initial kinetic energy was absorbed in the cases cited. (auth)

5903 ASAE-31
American-Standard. Atomic Energy Div., Mountain View, Calif.
LABORATORY MANUAL FOR THE UTR-10. Feb. 5, 1958. 54p.

The UTR-10 (University Training Reactor), a light-water moderated and cooled graphite-reflected thermal reactor which provides a flux of 10^{11} n/cm^2-sec, is described. The reactor experiments which can be performed are outlined and procedures given. (T.R.H.)

5904 CF-58-12-101
Oak Ridge National Lab., Tenn.
LIQUID-SOLID FLUIDIZATION STUDIES. L. D. Felten and D. G. Thomas. Dec. 19, 1958. 33p. Contract [W-7405-eng-26]. $6.30(ph OTS); $3.00(mf OTS).

Liquid-solid fluidization studies at room temperature were initiated to evaluate the severity of flow instabilities associated with fluidized beds. In these exploratory tests, bubbling a moderate amount of gas through the fluidized bed completely disrupted the flow pattern. Inclining the cylindrical container at angles up to 20° from the vertical did not appear to affect the stability of the upper interface between the fluidized bed and disengaged water; however, at the larger angles pronounced channeling of the water was observed. Agglomeration was indicated in hindered settling tests even though the mean primary particle diameter was about 15 microns. Since the fluidization and hindered-settling velocities were essentially equal, the agglomeration may have existed in fluidization tests also. None of the above instabilities are believed to be sufficiently serious to eliminate the use of the fluidization technique in the design of nuclear reactor cores. Based on heat transfer considerations, calculations indicate that ThO_2 particles 20 to 30 microns in diameter would be of interest for large, single-region fluidized-bed reactors. Thorium oxide particles of 150 to 1500 microns diameter would be of interest for the blanket region of two-region breeder reactors. (auth)

5905 CF-59-1-34
Oak Ridge National Lab., Tenn.
OPERATION OF THE HRT WITH DIFFERENT CORE AND BLANKET TEMPERATURES. M. W. Rosenthal and R. Chalkley. Jan. 15, 1959. 4p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

A parameter study was made of some of the nuclear characteristics the HRT would have if the core and blanket were operated at different temperatures. The power density in the fuel solution at the inner surface of the core tank was found to be affected very little by the temperature distribution. However, the thermal flux at the core-tank wall increased when the blanket temperature was reduced (a consequence of the reduced critical concentration). (auth)

5906 HW-58555
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
DIVISION OF REACTOR DEVELOPMENT PROGRAMS MONTHLY REPORT [FOR] NOVEMBER 1958. L. H. McEwen, comp. Dec. 15, 1958. 27p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

Fabrication, irradiation, and testing of plutonium fuels for the Plutonium Recycle Program are described. Work is reported on PuO_2–UO_2, Al–Pu, and graphite–Pu systems. The development of UO_2 fuel for the program is reviewed. Work is summarized on coolant systems, structural materials, mechanical equipment, and design development. Shielding studies and the plutonium fabrication pilot plant work are described. Chemical, physical, and instrumental research and development are reported for PRP. The production of highly purified uranium for use in the Basic Swelling Studies Program is described. Graphite oxidation and compression strength were studied in connection with the Gas Cooled Central Station Power Reactor Program. Nondestructive testing research is described. (For preceding period see HW-58019 A2.) (W.D.M.)

5907 HW-58860
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
DIVISION OF REACTOR DEVELOPMENT PROGRAMS MONTHLY REPORT [FOR] DECEMBER 1958. Jan. 15, 1959. 36p. Contract W-31-109-Eng-52. $6.30(ph OTS); $3.00(mf OTS).

In the Plutonium Recycle Program, brief reports of preparation of sample fuel materials for irradiation testing are given. Design of Al–Pu clusters for ETR irradiation testing is discussed. Data on sintering of UO_2–PuO_2 mixtures are given. Studies are also reported on: injection casting; extrusion of Al–U; welding Zircaloy-2 tubing; gross melting of unsintered UO_2 in Zircaloy-2 tubes; coolant systems development; thermal hydraulics; mechanical equipment development; design development; pyrochemical processing of PRP fuels; PRTR fuels processing; computer programming operation; Gas Cooled Central Power Station Reactor; Army Gas-Cooled Reactor; and nondestructive fuel testing. (For preceding period see HW-58555.) (T.R.H.)

5908 IDO-16465
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
HYDRAULICS OF MODIFIED FUEL ELEMENTS FOR ETR. R. G. Beck. Nov. 7, 1958. 30p. Contract AT(10-1)-205. $1.00(OTS).

Issued May 7, 1958 under the number PTR-306. Presented at the Los Angeles meeting of the American Nuclear Society, June 1958.

Unequal flow distribution through the original ETR fuel element exerted excessive forces on fuel plates that were initially deformed from brazing heat used in attaching the fuel plates to the side plates. Improvement in fabrication techniques provided a fuel element strong enough to safely allow coolant velocities of 35 ft/sec which provided 175 Mw reactor operation. Modification in the fuel element design permits more efficient fuel element cooling and will reduce the required reactor coolant flow by about 15% for 175 Mw operation. A summary, showing the ETR flow requirements for 175 Mw operation with each type of fuel element, is given. (auth)

5909 KAPL-2000-4
Knolls Atomic Power Lab., Schenectady, N. Y.
REACTOR TECHNOLOGY QUARTERLY REPORT NO. 7. PHYSICS. Dec. 1958. 109p. Contract W-31-109-Eng-52. $2.75(OTS).

Reactor Theory. A generalized criterion for xenon instability and flux tilting during xenon override are discussed. An analysis is made of epithermal capture effects in control rod evaluation. The absorption area of black control rods in media of arbitrary absorption is determined. Work is reported on the transport and Boltzmann equations. Escape probabilities for anisotropic scattering are discussed. The slowing-down kernel for delayed neutron groups was calculated. The theory of pulsed neutrons in multiplying media is discussed. The influence of europium and plutonium absorbers on reactor parameters was determined. Burnable Poisons. Dysprosium depletion studies and burnup calculations for unshielded europium and dysprosium chains are reported. Depletion of poisons involving isotopic chains is discussed. Cross Sections. Neutron capture, epithermal absorptions, and inelastic scattering parameters in zirconium are discussed. Isotopic abundances and cross sections for boron are reported. Experimental Physics. Studies of the dependence of oxygen activation on the presence of inelastic scattering materials are presented. A pulsed neutron reactivity measurement and a measurement of the effective delayed neutron fraction by the substitution method are reported. Three separate lattices were investigated in a heterogeneity study. Mathematical Theory and Methods. A mathematical theory of neutron diffusion is presented, and the techniques used in the CURE program are described. The REM, TRIXY, BOX, and cross section codes are described. (For preceding period see KAPL-2000-3.) (W.D.M.)

5910 KAPL-M-S3G-RES-65
Knolls Atomic Power Lab., Schenectady, N. Y.
AN EVALUATION OF THE KAPL-PTR FACILITY. C. S. Hofmann, J. H. Holmes, and R. G. Luce. Jan. 26, 1959. 26p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

The KAPL-PTR, a high-temperature zero-power critical facility, is briefly described and evaluated from an engineering viewpoint. The evaluation is based on operating experience gained since April 1958 when the facility was put into operation. Although a number of specific faults have occurred in the operation of the PTR, they do not reflect on the basic designs employed. (W.D.M.)

5911 NP-7129
Brussels. Centre d'Étude de l'Énergie Nucléaire.
EXPLOITATION BR-1. RAPPORT D'AVANCEMENT. DEUXIEME TRIMESTRE 1958. (BR-1 Operation. Progress Report. Second Quarter 1958.) M. de Dorlodot. 13p.

The operational characteristics of the BR-1 are tabulated, and a list of experiments initiated is given. (J.S.R.)

5912 NP-7130
Brussels. Centre d'Étude de l'Énergie Nucléaire.
INSTALLATIONS ANNEXES A LA PILE BR-2. (Annex Installations to the BR-2 Reactor.) J. Planquart. Nov. 1958. 26p.

The annex installations of the BR-2 reactor are described in detail. The general philosophy for the grouping of the auxiliary equipment is discussed. The manipulation of the radioactive materials under water and in dry cells is considered, and the work levels are described. (J.S.R.)

5913 NP-7138
Brussels. Centre d'Etudes pour les Applications de l'Energie Nucléaire.
BOUCHON EN MATIERE PLASTIQUE POUR BR1. (Plastic Shields for the BR-1.) L. Ghoos. Jan. 9, 1958. 7p.

The use of a mixture of plastic and lead as plugs for the experimental beam holes of the BR-2 is considered. The concentration which this mixture must have to attenuate the radiation was calculated. It was found that the composition must be between the following limits: 25% lead with 75% polyethylene and 62% lead with 38% polyethylene. The first composition is preferable. A plug length of 160 cm reduces the total dose to 2.5 mrem/hr in the first case and to 2 mrem/hr in the second. The polyethylene can be replaced by paraffin without changing the proportions. If a mixture of 25% lead with 75% polystyrene is used, the length of the plug should be increased to 207 cm. (tr-auth)

5914 NP-7140
Brussels. Centre d'Étude de l'Énergie Nucléaire.
CONSTANTES NUCLEAIRES A UTILISER POUR LE

NOYAU DE BR-2. (Nuclear Constants Used for the Core of the BR-2.) P. De Myttenaere. July 17, 1958. 28p.

There is no reactor using highly enriched uranium at present in which the moderator is composed of beryllium and water in proportions similar to those of the BR-2. To predict the critical radius, it is necessary to know accurately the nuclear constants of the various regions. The determination of these constants by different methods gives strongly divergent results, which are discussed separately. In an appendix the calculation of the constants and the composition of the various regions are reviewed. (J.S.R.)

5915 NP-7149
Brussels. Centre d'Etudes pour les Applications de l'Energie Nucléaire.
CHENAL EXPERIMENTAL POUR L'ETUDE DE L'EXTRACTION DE LA CHALEUR DU REACTEUR BR-1. (Experimental Channel for the Study of Heat Removal from the BR-1 Reactor.) P. Marien. Nov. 15, 1957. 46p.

To augment the thermal power and the neutron flux at the center of the BR-1 reactor, the use of natural uranium rods whose aluminum cladding would have fins was proposed. In order to study the performances of fuel elements fabricated with fins, an experimental channel was constructed in the reactor. A brief description is given of a previous channel with special emphasis on its defects which are to be remedied in the new facility. The experimental channel is a tube of graphite connected to the inlet section by a rubber tube reenforced by a metallic spiral. The fabrication and assembling of the channel are described in detail. The controls used to assure the correct geometry, air tightness, and the temperatures of the air, claddings, and graphite are discussed. (J.S.R.)

5916 NP-7157
Brussels. Centre d'Étude de l'Énergie Nucléaire.
REACTEUR BR-2—AILE CHAUDE—DESCRIPTION DU COMPLEXE DES CELLULES BLINDEES. (Reactor BR-2—The Hot Wing—Description of the Complex of Shielded Cells.) J. P. Valentin. June 17, 1958. 49p.

The hot cells of the process buildings for the BR-2, in which radioactive materials are stored and processed, are described in detail. The construction, interior and exterior dimensions, the doors, manipulators, windows, plugs, drainage at the interior and to the exterior, ventilation, lighting, and television are considered. In addition, the permissible overloads on the cell floors and the organization of the cells are discussed. (J.S.R.)

5917 NP-7169
Brussels. Centre d'Étude de l'Énergie Nucléaire.
LES FACILITES POUR DES IRRADIATIONS GAMMA AU C.E.N. A MOL. (Facilities for Gamma Irradiations at the C.E.N. at Mol.) M. De Proost. Nov. 1958. 8p.

The Centre d'Étude de l'Énergie Nucléaire has at its disposal the following facilities for gamma irradiation research: used fuel elements in the hydraulic channel of the BR-1, a hot cell, and a cobalt source of 6,500 c. Each is briefly described. The investigations planned are indicated. (J.S.R.)

5918 NP-7206
North Carolina State Coll., Raleigh.
A STUDY OF THE FISSION GASES FROM THE WATER BOILER REACTOR. H. A. Lamonds. 1958. 116p. Contract DA-36-034-ORD-1656.

The gamma-emitting activity in the off-gas of the Raleigh Reactor was studied. Air was passed through the reactor core to extract the fission gases, and the off-gas stream was then passed through a cell mounted near a scintillation detector. Purge flow rates up to 2000 cc/min were used resulting in total transit times as short as 33 seconds. Measurements were made on both the fission gases and their daughter products. Curves are given showing the expected specific activities of the fission gases and their daughter products. These were calculated on the IBM 650 computer using data found in the literature. Measurements were made on the gross decay of gamma-emitting isotopes of both gases and their daughter products. The results of these measurements are compared with calculated values. The relationship between gas evolution rate and reactor power is also investigated. A computer program was developed for obtaining the "least squares best fit" of a sum of exponentials to experimental data. This was used in analyzing decay curves. The investigation produced substantial evidence of the existence of short-lived gamma-emitting isotopes not tabulated in the literature. Gamma-ray spectra taken of the gases and their daughters help to substantiate this postulate. Values are given for the average transit time of fission gases in the reactor fuel solution. A description is given of the instrumentation developed for automatic measurement of decay curves. (auth)

5919 NRL-5196
Naval Research Lab., Washington, D. C.
NAVAL RESEARCH LABORATORY RESEARCH REACTOR. PART VIII. NEUTRON FLUX MEASUREMENTS AND POWER DETERMINATIONS. E. H. Bebbs and H. Clay Price, Jr. July 25, 1958. 48p. Project No. NR-543-000.

Part VII issued as NRL-5189.

Measurements were made of the thermal and epicadmium neutron flux distribution in the NRL Research Reactor for a number of core configurations. A power determination based on the flux measurements for a graphite–water reflected core was made. (W.D.M.)

5920 VAL-67
General Electric Co. Vallecitos Atomic Lab., Pleasanton, Calif.
NEUTRON THERMALIZATION CALCULATIONS FOR A HETEROGENEOUS LATTICE CONTAINING URANIUM AND PLUTONIUM FUEL IN WATER. P. Greebler, W. H. Harker, and J. M. Harriman. Apr. 14, 1958. 16p. (GEAP-3001).

Plutonium buildup in a low enrichment reactor at sufficiently high temperature that the Pu^{239} absorption cross section departs appreciably from 1/v increases the sensitivity of the calculated thermal cross sections to the thermalization techniques used. Thermal neutron spectra are calculated for a heterogeneous lattice of a low enrichment water-moderated reactor. Using blackness theory, equivalent homogeneous, monoenergetic cross sections for the lattice are computed at closely spaced energy intervals over the thermal energy range. The energy distribution of the thermal neutron flux is then obtained using both the Wigner-Wilkins and the Wilkins thermalization equations. Calculations are made with the fuel elements assumed to contain only U^{235} and U^{238} yielding almost pure 1/v absorption, and also for the case of appreciable Pu^{239} present in addition to the uranium, resulting in a significant departure from 1/v absorption. Sensitivity of the calculated spectrum to the effective mass of the hydrogen is tested by allowing wide

variations of the $\xi\sigma_s$ values for water at low energies in several applications of the Wilkins equation. Variations in the thermal neutron spectra resulting from the choice of the thermalization equation, from changing $\xi\sigma_s$, or as a result of plutonium buildup are evaluated in terms of isotopic cross sections averaged over the spectrum in each case. (auth)

5921 AEC-tr-3559

THE INFLUENCE OF CELL CONFIGURATION ON THE LAPLACIAN AND FINE STRUCTURE OF THERMAL FLUX IN A HETEROGENEOUS REACTOR. B. Bailly du Bois. Translated by Liz Appleby (Hanford Atomic Products Operation) from report CEA-740, 1957. 36p. $6.30(ph); $3.00(mf) JCL or LC.

To calculate the Laplacian of a heterogeneous reactor, the Wigner-Seitz hypothesis which consists of representing the lattice cells by area-equivalent cylindrical cells is usually used. The corrections which are introduced when taking into account the true form of the cells are calculated. Calculations of the spatial diffusion of thermal neutrons and corrections in the thermal utilization factor are presented. The spatial diffusion of a group of slowing down neutrons and corrections to the escape factor are calculated. (W.D.M.)

5922

A PULSED REACTOR. T. N. Zubarev. Atomnaya Energ. 5, 605-17(1958). (In Russian)

Descriptions are presented of a pulsed reactor using ordinary water and enriched uranium, and a method is suggested for calculating the physical and thermotechnical parameters for the reactor. It is shown that under certain conditions it is possible to secure a greater heat-exchange stability with neutron pulses. Calculations show that the proposed design can achieve a thermal power of ≥ 5000 kw with $\geq 10^{14}$ neutrons/cm^2/sec mean thermal neutron flux in the active zone and $\sim 10^{17}$ neutrons/cm^2/sec maximum during the neutron burst. (tr-auth)

5923

ACTIVITY IN THE COOLING AGENTS OF REACTORS AND THE DETECTION OF ESCAPE OF FISSION PRODUCTS. I. J. Labeyrie. Bull. inform. sci. et tech. No. 13, 12-22(1958) Jan. (In French)

An investigation is made on the detection of ruptures in fuel claddings by methods utilizing the β, γ, or neutron activity of fission products appearing in the liquid coolant from the rupture. The circumstances of the attack on the fuel by the coolant, the process of the appearance and development of the rupture, and the nature and quantity of the fission products escaping are defined first. A comparative examination of the possibilities of detection by means of different fission nuclides is made. (tr-auth)

5924

ACTIVITY IN THE COOLING AGENTS OF REACTORS AND THE DETECTION OF ESCAPE OF FISSION PRODUCTS. II. J. Labeyrie. Bull. inform. sci. et tech. No. 14, 2-13(1958) Feb. (In French)

The normal activities to be found in the reactor coolants, such as air, light and heavy water, compressed CO_2, organic fluids, and liquid sodium, are discussed. An examination of the procedures for the separation of fission product activity from the normal activity of the coolant is made. Coolants of air, light and heavy water, and compressed CO_2 are considered. (J.S.R.)

5925

CRITICAL ASSEMBLY OF URANIUM–BERYLLIUM OXIDE. C. Gourdon, J. Martelly, M. Sagot, and G. Wanner. Bull. inform. sci. et tech. No. 16, 9-17 (1958) Apr. (In French)

Sub-critical Laplacien measurements were made on uranium–beryllium oxide lattices by the classical exponential method and the "Neutrostat" method. The assembly used was an orthocylinder with a vertical axis. It was composed of 7.5 tons of BeO with 90 fuel channels with a cross section of 5×5 cm^2, arranged in a square lattice of 15 cm pitch. By charging the assembly with 700 kg of uranium, enriched to 1.36%, it was possible to attain criticality under quite favorable conditions. The assembly has no radial reflector and the axial reflectors were poisoned with cadmium to have a very small albedo and to avoid a perturbation of the neutron spectra. Cadmium tubes around each uranium rod were moved up or down to control the reactivity. The material buckling, photoneutron effect in BeO, and the temperature and pressure coefficients of reactivity were studied. (J.S.R.)

5926

CORROSION PROBLEMS IN GAS COOLED REACTORS. R. Darras. Bull. inform. sci. et tech. No. 21, 13-25 (1958) Sept. (In French)

The corrosion behavior of different materials used in gas-cooled reactors is reviewed. A brief report is made on the dry oxidation of metals and the methods of investigation. The materials studied are the nuclear fuels (uranium and its compounds), canning materials (magnesium, aluminum, zirconium, and beryllium and their alloys and stainless steel), and moderators (graphite and beryllium oxide). An attempt is made to specify the temperature limits for each material in various gases. The possibilities of improving the energy yield of gas cooled reactors by the use of more refractory materials or the use of other gases is discussed. 38 references. (auth)

5927

AVERAGE FLUX IN REACTOR TEST VOLUMES. Raymond L. Murray, Gerald H. Katzin, and Alfred L. Mowery, Jr. (North Carolina State College, Raleigh). Nuclear Sci. and Eng. 5, 69-70(1959) Jan.

The prediction of reaction rates of neutrons with nuclei within a finite sample in a research or test reactor requires the computation of the average neutron flux over the region. Formulas are presented that facilitate such evaluations for off-center samples. Cylindrical symmetry of the basic reactor flux distribution is assumed. (W.D.M.)

5928

LIQUID FUEL ELEMENTS. I. Th. v. d. Plas. R C N Bull. 2, 142-6(1958) Nov. (In Dutch)

The possible applications of liquid fuel elements is discussed. In this first part of the series, liquid metals and molten salts are considered. (J.S.R.)

5929

RESEARCH REACTORS. Sergio Gallone (CISE, Milan). pp. 177-93 in "Atti del Congresso Scientifico. Volume I. Sezione Nucleare, Giugno 1957." (In Italian)

The general characteristics of research reactors are briefly reviewed. The fields of application of a research reactor are considered. Four types of research reactors are discussed: the water boiler, swimming-pool, graphite, and heavy or light water reactors. The safety of research reactors is indicated. (J.S.R.)

5930
LONG TERM STUDIES IN REACTOR PHYSICS. C. G. Campbell (United Kingdom Atomic Energy Authority, Harwell, Berks, Eng.). pp. 277-87 in "Atti del Congresso Scientifico. Volume I. Sezione Nucleare, Giugno 1957."

A brief description is given of experiments to determine the physical properties of reactor core assemblies. The objective of these studies is the accurate prediction of the origins and fates of the neutrons present in any particular arrangement of a reactor core and of the changes in these neutron sources and fates during the operation of the reactor. The use of both critical and subcritical assemblies is discussed. (J.S.R.)

5931
TABLES OF ϕ^n FOR REACTOR SLABS, CYLINDERS, AND SPHERES n = 1 TO n = 20. Bulletin No. 70. Raymond L. Murray and Lawrence A. Mink. Raleigh, North Carolina State College, 1958. 58p. $1.50.

Power

5932 A/CONF.15/P/450
Oak Ridge National Lab., Tenn.
DESIGN STUDY FOR A GRAPHITE-MODERATED GAS-COOLED REACTOR USING PARTIALLY ENRICHED URANIUM. R. A. Charpie, M. Bender, A. P. Fraas, W. T. Furgerson, W. H. Jordan, W. D. Manly, R. V. Meghreblian, A. M. Perry, and R. D. Schultheiss. 16p. $0.50(OTS).

Prepared for the Second U. N. International Conference on the Peaceful Uses of Atomic Energy, 1958.

A summary is presented of the research and development aspects of the U. S. program for graphite-moderated, gas-cooled reactors using partially enriched uranium. The availability of helium and enriched uranium in the United States presents a large degree of design freedom. On the basis of the study, it is concluded that such a reactor will produce power cheaper than a reactor using natural uranium. At the present time gas-cooled reactors are technologically and economically competitive with the best available pressurized-water reactors. (J.S.R.)

5933 A/CONF.15/P/606
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
APPLICATION OF ORGANIC MODERATED REACTORS TO CENTRAL STATION POWER PLANTS. E. F. Weisner and W. E. Parkins. 12p. $0.50(OTS).

Prepared for the Second U. N. International Conference on the Peaceful Uses of Atomic Energy, 1958.

A discussion is presented on organic moderated and cooled reactors which includes design, cost, and performance figures. The proposed materials to be used for construction of the reactor and components are also included. (W.L.H.)

5934 A/CONF.15/P/1067
Division of Reactor Development, AEC and Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
THE PHYSICS ASPECTS OF SEED AND BLANKET CORES WITH EXAMPLES FROM PWR. A. Radkowsky and R. T. Bayard. 47p. $0.50(OTS).

Prepared for the Second U. N. International Conference on the Peaceful Uses of Atomic Energy, 1958.

The physics aspects of seed and blanket cores, including the conceptual basis, design problems and procedures, and the long-term prospects and future development of this reactor type, are presented. The work is limited to studies of light-water-moderated cores. The PWR core is used as an example to illustrate the principles outlined and to furnish a comparison of theory and experience. (J.S.R.)

5935 A/CONF.15/P/1831
General Nuclear Engineering Corp., Dunedin, Fla. and Division of Reactor Development. Maritime Reactors Branch, AEC.
THE USE OF NUCLEAR ENERGY FOR PURPOSES OTHER THAN THE GENERATION OF ELECTRICITY. W. H. Zinn and R. P. Godwin. 36p. $0.50(OTS).

Prepared for the Second U. N. International Conference on the Peaceful Uses of Atomic Energy, 1958.

The use of the nuclear reactor for purposes other than the generation of electricity is examined within the framework of three substances which can be produced by the reactor. These are steam, hot gases, and nuclear radiation, principally neutrons and gamma rays. The present and future projected costs of producing steam of the quality required for various purposes are reviewed, such as space heating, evaporation and purification of water, heating and drying in manufacturing operations such as in the paper industry, and the use of steam directly in chemical processes such as the gasification of coal. Reactors for the production of high-temperature gases are discussed, and the principal technical difficulties encountered are reviewed. The gas temperatures of interest are approximately 2000°F and above. Ship propulsion with nuclear reactors is discussed in the light of the known costs for constructing and operating nuclear reactors. The principal characteristics of the first USA nuclear-propelled merchant ship are reviewed, and the possible economic advantage of nuclear power for long hauls is discussed. The application of the high-temperature gas turbine to ship propulsion is reviewed also, and possible advantages are pointed out. The radiation produced by the reactor may be used in certain chemical industrial processes and for food preservation. The suitability of the sodium coolant from a power reactor for these purposes is examined. The economic feasibility of constructing and operating a reactor solely for the large-scale production of a radioisotope, such as cobalt-60, is examined with special emphasis on the practical conversion ratios to be expected in reactors designed for this purpose. (auth)

5936 A/CONF.15/P/1852
Allis-Chalmers Mfg. Co., Milwaukee.
A CONTROLLED RECIRCULATION BOILING WATER REACTOR WITH NUCLEAR SUPERHEATER. C. B. Graham, R. J. Hall, R. W. Klecker, C. E. Klotz, and R. G. Michel. 9p. $0.50(OTS).

Prepared for the Second U. N. International Conference on the Peaceful Uses of Atomic Energy, 1958.

A 66 Mwe nuclear power plant, known as the Sioux Falls Power Reactor, designed by Allis-Chalmers Manufacturing Company for the Northern States Power Company. Steam at 600 psi is generated in this boiling water type reactor and passes to a conventional turbine. Very high power densities are obtained by pumping a large volume of water through the reactor core. Pump speed may be varied to control the reactor. An efficiency greater than 30% is anticipated, and minimum capital costs are attained because of the high power density, use of normal water, and general simplicity of design. (auth)

5937 AECU-3855
General Electric Co. General Engineering Lab., Schenectady, N. Y.
MAIN COOLANT FLOW INSTRUMENTATION—PROJECT D1G. James B. McFerran and George F. Skala. July 14, 1958. 76p. (58-GL-211). $12.30(ph OTS); $4.50(mf OTS).

The main coolant flow instrumentation equipment provides a working model of the system needed to protect against loss-of-flow conditions. A coördinated system involving transistor amplifiers, frequency converters, rate circuits, magnetic logic amplifiers, and other elements was developed and built. Protection is provided against loss-of-flow and power-to-flow ratio faults. (auth)

5938 AECU-3943
Duquesne Light Co., Shippingport, Penna.
MONTHLY OPERATION REPORT [FOR] SEPTEMBER 1958. George Rifendifer. 50p. Contract AT(11-1)-292. $7.80(ph OTS); $3.30(mf OTS).

Maintenance and testing, chemistry, instrumentation system, and training program work are reported. (For preceding period see AECU-3942.) (T.R.H.)

5939 AECU-3984
Duquesne Light Co., Shippingport, Penna.
STATION SHUTDOWN TESTS. SECTION II. Test Results DL-S-168 (T-554929). First Issue, Dec. 1, 1958. 27p. $4.80(ph OTS); $2.70(mf OTS).

Determination of the plant operating performance during a simulated shutdown in preparation for station maintenance or refueling is reported. The procedure used was considered adequate and effective for the performance of the shutdown operation. The station was shutdown and the reactor coolant temperature reduced to 130°F in a period of approximately 26 hr. After shutting down the main coolant pumps, the coolant temperature rose slowly to 180°F. With the 1AC core removal cooling loop in service, the coolant temperature was reduced from 180°F to below 100°F in a period of 21 hr. (auth)

5940 AECU-3986
Duquesne Light Co., Shippingport, Penna.
MONTHLY OPERATING REPORT [FOR] NOVEMBER 1958. 46p. Contract AT(11-1)-292. $7.80(ph OTS); $3.30(mf OTS).

Reactor operation, reactor plant and turbine plant chemistry, health physics studies, maintenance work, and test program and training program work are reported. (See also AECU-3943.) (T.R.H.)

5941 AECU-3991
Nuclear Products-Erco Div., ACF Industries, Inc., Washington, D. C.
ELK RIVER REACTOR PROJECT QUARTERLY REPORT NO. 1 [FOR] JUNE, JULY, AUGUST 1958. 26p. Contract AT(11-1)-654. (ACF-ERR-1). $4.80(ph OTS); $2.70(mf OTS).

Engineering and design of the Elk River Reactor was initiated on May 29, 1958. The AEC contract provides for ACF, as prime contractor, to design, develop, fabricate, construct, start-up, and test operate a closed cycle boiling water reactor and related equipment and train operating personnel. The reactor plant is to consist of a 58 Mwh, heterogeneous, light water moderated and cooled, natural circulation, closed cycle boiling water reactor and separately fired superheater. The initial work on hazards studies, fuel element development, and reactor vessel is reported. Construction progress is indicated. (W.D.M.)

5942 AECU-3993
Nuclear Products-Erco Div., ACF Industries, Inc., Washington, D. C.
PRESCOPING OPTIMIZATION FOR SELECTION OF ENRICHED URANIUM GAS-COOLED POWER REACTOR DESIGN. W. Farmer, E. Hill, P. Lang, K. Trickett, and S. Matovich. Feb. 14, 1958. 6p. Contract AT(10-1)-925. (ACF-GCPR-101). $1.80(ph OTS); $1.80(mf OTS).

A preliminary set of performance calculations was made for enriched reactor cores based on five cylindrical vessel designs ranging from 13 to 36 ft in diameter. Both 7 and 19 rod UO_2 stainless steel clad cluster fuel elements were employed in this survey. These two fuel element designs appeared adequate to cover the potential range of interest. A lattice spacing of 7.75 inches was employed throughout as probably leading to a reasonable uranium enrichment. The number of channels per core was established in preliminary core layouts by the mechanical group. The inlet temperature was established as 450°F, and an outlet temperature was determined for a 1300°F limiting surface temperature on the stainless steel. An optimum flow rate was established on the basis of two alternate criteria: pumping power equal to 15 per cent of gross electric power and pumping power equal to 10 per cent of gross electric power. The results of this comparison are given. In order to further select a design, capital costs per kilowatt of net electric plant power output were estimated. The performance results for the 7 rod cluster fuel element and pumping power equal to 10 per cent of gross electric power were used to make a capital cost versus vessel size comparison. (auth)

5943 AECU-4013
Nuclear Products-Erco Div., ACF Industries, Inc., Washington, D. C.
ELK RIVER REACTOR PROJECT QUARTERLY REPORT NO. 2 [FOR] SEPTEMBER, OCTOBER, NOVEMBER 1958. 35p. Contract AT(11-1)-654. (ACF-ERR-2). $7.80(ph OTS); $3.30(mf OTS).

Design and construction are proceeding on schedule. Physics and shielding calculation results are reported and discussed. Studies of the high-pressure B injection safety system are described. The programs for fuel element and materials development, reactor vessel and internal components, process and superheater, reactor building and plant facilities, and instrumentation are outlined. (For preceding period see AECU-3991.) (T.R.H.)

5944 ANL-5744
Argonne National Lab., Lemont, Ill.
HAZARD SUMMARY REPORT ON THE ARGONNE LOW POWER REACTOR (ALPR). Abraham Smaardyk, ed. Oct. 1957. 107p. Contract W-31-109-eng-38. $2.50 (OTS).

The over-all design of the Argonne Low Power Reactor is presented. Detailed design data are given as well as information concerning the hydrology, seismology, and meteorology of the building site (NRTS). In addition, a description of the reactor instrumentation and control, mechanical design, heat transfer, and related physics are presented. A full description of the power plant, including the steam and electrical systems, is also given, as well as the operating procedure for both normal and emergency conditions. Over-all reac-

tor safety is evaluated. Diagrams and graphs are included. (J.R.D.)

5945 BAC/RL-1052
Bendix Aviation Corp. Research Labs., Detroit.
ANALYSIS OF THE POWER LIMITING SYSTEM FOR THE ENRICO FERMI ATOMIC POWER PLANT. Nov. 1, 1958. 199p. Project 2528. For Atomic Power Development Associates, Inc.

A study was made of the Enrico Fermi Atomic Power Plant to determine the salient features of its power-limiting system. The transients induced by reactivity insertions and coolant flow changes were studied with an analog computer. Using these data, the power-limiting system was designed. Besides the scram action, two more responses of the system were proposed. These are "setback" and "sequential scram." The setback acts to reduce the power when a preset limit is exceeded but does not shut the reactor down. The sequential scram is the response that minimizes thermal shock when the reactor must be shut down because of power transients or the multiple failure of coolant pumps. With the data obtained from the analog computer study, trip levels at which the various responses must be initiated were set. In addition, a recommendation of the flow and temperature interlock functions needed to protect the plant was made. An analysis of the statistical fluctuations of growth factors and power derivative signals is presented. A set of general specifications for the power-limiting equipment, including a block diagram of the logic circuits, was drawn up. (auth)

5946 BAW-1014
Babcock and Wilcox Co. Atomic Energy Div., Lynchburg, Va.
LIQUID METAL FUEL REACTOR EXPERIMENT RESEARCH AND DEVELOPMENT PROGRAM. June 1957. 118p. Contract AT(30-1)-1940. $2.75(OTS).

A research and development program is outlined which is felt necessary to provide specific engineering information required for the design, construction, and operation of the Liquid Metal Fuel Reactor Experiment. The objective of the materials testing program is to confirm the suitability of Croloy-2¼ and graphite as construction materials for LMFRE under defined conditions. A program is described for investigating graphite to metal seals, Be to Croloy joints, various types of valves, and reactor fluid dynamics. Programs are outlined for instrumentation and chemical processing problems. (W.D.M.)

5947 BAW-1046
Babcock and Wilcox Co. Atomic Energy Div., Lynchburg, Va.
EXTERNALLY COOLED LIQUID METAL FUEL REACTOR DESIGN STUDY. C. E. Thomas, ed. Mar. 1958. 148p. Contract AT(30-1)-1940. $22.80(ph OTS); $7.20(mf OTS).

The Babcock & Wilcox Company has investigated two basic design concepts for an externally cooled Liquid Metal Fuel Reactor (LMFR). One concept utilizes a single fluid, a uranium–thorium–bismuth slurry, as the coolant, fuel, and fertile material. The other concept incorporates a uranium–bismuth solution as the coolant-fuel in the core and a thorium–bismuth slurry as the coolant-fertile material in a blanket surrounding the core. Reference designs were developed for each concept, single fluid and two fluid, based upon current technology, plus expected developments in technology during the next ten years, and a set of economic ground rules which allow comparison of the two concepts with each other as well as with other reactor types. The single-fluid design has the advantages of simpler core design, and more flexibility in choice of parameters. The two-fluid design has the advantage of a higher breeding ratio. A thorough economic analysis, based upon the ground rules recorded in this report, does not indicate an economic advantage of one concept over the other. For a plant electrical output of 315,000 kw and a plant capacity factor of 80%, the net electrical energy costs are approximately 7.0 mills/kwh for each design. (auth)

5948 BAW-1123
Babcock and Wilcox Co. Atomic Energy Div., Lynchburg, Va.
CONTAINMENT PRESSURE ANALYSIS REPORT. James E. Lemon and Jesse C. Ellington. Oct. 10, 1958. 13p. Contract AT(30-3)-274. $3.30(ph OTS); $2.40 (mf OTS).

An analysis made to determine the maximum pressure existing in the containment vessel of the USAEC Nuclear Merchant Ship Savannah after a maximum credible incident is presented. The maximum credible incident considered is a primary rupture that causes release and expansion of the total primary system water and the secondary steam–water mixture from one steam generator. The analysis considers both the rate of leakage through the primary system rupture and the rate of heat absorption from the flashed mixture by the colder, uninsulated surroundings. The results of this analysis show that the containment pressure rises for approximately 24 sec after an incident and then decreases. The maximum pressure is 173 psig. (auth)

5949 GET-2537A
Ingalls Shipbuilding Corp., Pascagoula, Miss. and General Electric Co., Schenectady, N. Y.
NUCLEAR POWER FOR MERCHANT VESSELS. C. H. Johnson and P. V. Johnson. [1955]. 23p.

Supersedes GET-2537.

The general characteristics of the various types of nuclear power plants being developed are described, and the possibilities of applying each of these for use aboard a merchant vessel are discussed. Background is given on both heterogeneous and homogeneous reactors. The pressurized water reactor, boiling water reactor, and liquid metal cooled reactor are discussed separately. (W.D.M.)

5950 KAPL-M-AME-15
Knolls Atomic Power Lab., Schenectady, N. Y.
ASSEMBLY OF S3G REACTOR CELLS AT KAPL. Thomas B. Smith. Nov. 26, 1958. 51p. Contract [W-31-109-Eng-52]. $9.30(ph OTS); $3.60(mf OTS).

The parts lists and assembly procedure for S3G reactor cells are given. (T.R.H.)

5951 KAPL-M-HWB-1
Knolls Atomic Power Lab., Schenectady, N. Y.
PROCEDURE FOR CALCULATING DECAY POWER AND "READY TIME" AFTER REACTOR SHUTDOWN. H. W. Bassett. Jan. 6, 1959. 11p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

A simple method of calculating the decay power of a reactor at any given time after its shutdown is described. As an example, a reactor operating history was assumed and the calculation performed. (W.D.M.)

5952 KAPL-M-JS-4

Knolls Atomic Power Lab., Schenectady, N. Y.

A GENERALIZED CRITERION FOR XENON INSTABILITY. J. C. Stewart. Dec. 18, 1958. 17p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

The criterion for stability of a power reactor against xenon oscillations is derived in a form applicable to multigroup reflected reactor models. (auth)

5953 NDA-14-179

Nuclear Development Corp. of America, White Plains, N. Y.

TRANSIENT FUEL AND COOLANT TEMPERATURES IN THE ENRICO FERMI REACTOR CORE DURING A PERIOD OF FLOW REVERSAL. Harold G. Elrod, Jr. July 30, 1957. Includes Appendixes A, B, and C. 35p. $6.30(ph OTS); $3.00(mf OTS).

An accident to be investigated as a part of the APDA safety studies is that which would involve meltdown at full power of the APDA reactor with gravity loss of sodium from both the top tank and core. An analysis is presented, permitting a logical prediction of the transient temperatures occurring prior to the time when boiling begins, due to flow reversal and other factors. The calculation method is given as well as the results of application of the method to a numerical example. (J.R.D.)

5954 NP-7118

Brussels. Centre d'Étude de l'Énergie Nucléaire.

COURS DE REACTEURS DE PUISSANCE. CONSTRUCTION. DESCRIPTION DES DIFFERENTS TYPES. EXTRACTION DE LA CHALEUR. (Course in Power Reactors. Construction. Description of Different Types. Heat Removal.) P. Marien. 1958. 182p.

A textbook to be used for a course in power reactors is presented. The topics discussed include construction of the reactor, comparison of the different types of reactors, water cooled reactors, gas cooled reactors, liquid metal cooled reactors, organic material cooled reactors, homogeneous reactors, reactor control, and heat removal from a reactor. (J.S.R.)

5955 ORNL-2561

Oak Ridge National Lab., Tenn.

HOMOGENEOUS REACTOR PROJECT QUARTERLY PROGRESS REPORT FOR PERIODS ENDING APRIL 30 AND JULY 31, 1958. Feb. 4, 1959. 361p. $5.00(OTS).

Homogeneous Reactor Test. Operation-at-power runs are described in which several difficulties were experienced. The operating experiments are described and discussed in some detail. Processing plant radioactive operation is reported. Thermal and stress analysis data from these power runs are presented, and the nuclear characteristics are calculated. Component development proceeded with 400A pump tests, installation of core-viewing equipment, flow model tests, and HRT mockup corrosion runs. Design studies for operation of the HRT as a single-region machine were completed. A new pressure vessel and a reactor-cell plug were also designed. Control and instrumentation developments are reported. Reactor Design, Research, and Analysis. Design of HRE-4 for slurry-fuel studies is being investigated. The nuclear characteristics of a homogeneous reactor with two concentric blankets with different Th concentrations were examined. The accuracy of measuring the breeding ratio of HRE-3 after operation was studied. The influence of the core inlet-outlet line on flux distribution in HRE-3 was calculated. The effect of core inlet line and core thickness on breeding ratio were studied. A criticality study of the blanket dump tanks is reported. A survey was made of small, one-region, ThO_2–water reactors fueled with U^{235}. The ORACLE code for spherical reactors was modified to include fissions in the fast group. Investigations of the flow characteristics of ThO_2 slurries are described. A viscometer and a 30-gpm loop for these studies are described. Thoria spheres were treated with chemicals to make them resistant to degradation. Engineering Development. Development of fuel and slurry system components continued with high-pressure recombiner loop repairs, studies of explosive limits of $D_2-\frac{1}{2}O_2-D_2O$ steam, solubility of $H_2-\frac{1}{2}O_2$ in UO_2SO_4 and in H_2O, and studies of corrosion of Ti by boiling UO_2SO_4 solution. Modification and installation of various pumps, pipes, valves, and seals are reported. Research in development of slurry systems is reported in detail. Reactor Materials Research. Research is reported on: stability of fuel solution versus Ni content; effect of soluble sulfate salt additions on corrosiveness of fuel solution; effects of O_2 on U precipitation and corrosion rate in fuel loop runs; corrosive effects of fuel solution on Yorkmesh entrainment separator; testing of stainless steel–Zircaloy-2 transition-expansion joint; corrosion of Ti, Zircaloy-2, and stainless steel by heavy phase of UO_2SO_4 solution at high temperature; corrosion of carbon and stainless steels by boiling water at 300°C containing 50 ppm chloride; Ru inhibition of UO_2SO_4 solution corrosion of stainless steel; and corrosion of 347 stainless steel, Ti, Croloy 16-1, Nionel, and Inconel in UO_2SO_4. Slurry corrosion studies reported are: construction and testing of a third slurry corrosion test loop; testing of venturi flowmeters; corrosion of stainless steels, Ti alloys, and Zircaloy-2 by thoria slurry in loops as affected by temperature and ThO_2 particle size; toroid corrosion tests of Ti 75A, carbon steel, stainless steel, and Zircaloy-3a, as affected by additions of $NaAlO_2$ and MoO_3; corrosion by silica sols containing Th; corrosion of Zircaloy-2 by UO_2-ThO_2 slurry at 280°; radiation corrosion studies in LITR loops of Zircaloy-2, Zr, types 347, 304L and 430L stainless steel, and Incoloy; autoclave solution experiments with additives of Li_2SO_4, silicotungstic acid, $KReO_4$, and $BeSO_4$; development of ternary Nb–Zr alloys; fabrication of Zircaloy-2; hydridation of Zircaloy-2; hydrogen content of Zr, Ti, and 430 stainless steel in recombiner loop; Charpy V-notch impact-energy of Zircaloy-2 versus fabrication procedure, H_2 content, specimen orientation, and notch orientation; impact tests of Zr and Zircaloy-3a exposed in in-pile loops; welding of Zircaloy-2 in air; ultrasonic attenuation in metals; ignition and combustion of Ti and Zircaloy-2; and effects of neutrons on tensile properties of steels. Chemical Engineering Development. Fuel processing studies include: radiation effects on iodate in simulated HRT fuel solution; dissolution of Ag from Yorkmesh in fuel solution; iodine in HRT during power operation; and hydroclone solids-removal tests. Gaseous-fission-product-disposal studies consisted of evaluation of inorganic adsorbents and varieties of charcoal for Kr and Xe adsorption. Blanket processing studies involved injecting Pu solution in P-1 loop containing UO_2SO_4 and observing the behavior. Adsorption of Pu on Dowex-50 was also studied. Thorium oxide slurry development continued with studies of: radiation effects on thoria slurries; radiation effects on a thoria–urania–silica sol; heat transfer in an idealized mockup of an ORR slurry autoclave irradiation facility; catalytic action of MoO_3 on radiolytic gas recombination; ThO_2 with chemi-

cally bonded silicate surface; effects of average particle size, uniformity, and shape on yield stress of aqueous ThO_2 slurries; classification of ThO_2 particles; settling during high-temperature ThO_2 slurry loop run; preparation of Th–U slurry mixture for HRE-4; and $Th(C_2O_4)_2$ precipitation. Redesign of the in-pile slurry loop is reported. Supporting Chemical Research. Calculations of the solubility of antlerite ($3CuO \cdot SO_3 \cdot 2H_2O$) in UO_3–CuO–SO_3–H_2O have been carried out. Phase-equilibrium date for NiO–SO_3–H_2O at 150 to 300°C are analyzed. The decomposition of peroxide in simulated HRT fuel solution was studied at 50, 70, and 90°C. A method for measuring the pH of suspensions was tested which is free of errors due to calomel electrode. ThO_2 slurries are strongly peptized by HNO_3. The fate of the neptunyl ion in nitric acid solution as $RbNpO_2(NO_3)_3$ in DNO_3–D_2O at 250°C was followed spectrophotometrically. Radionuclide determinations in HRT fuel solution from runs 13 and 14 were compared with calculated values. Analytical Chemistry. Improved methods were developed for the determination of Th, Zr, Ti, Al, F^-, and Cl^- in ThO_2. A Stanton thermobalance was used for thermogravimetric analysis in connection with ThO_2 production. The effect of CH_3COOH on the extractability of Th by TTA on CCl_4 was studied. Advances in the analytical chemistry of UO_2SO_4 solutions are discussed. The chemical analyses made incident to HRT runs 12 to 16 are discussed. (For preceding period see ORNL-2493.) (T.R.H.)

5956 ORNL-2649

Oak Ridge National Lab., Tenn. and Alco Products, Inc., Schenectady, N. Y.

SPECIFICATIONS AND FABRICATION PROCEDURES FOR APPR-1 CORE II STATIONARY FUEL ELEMENTS. J. E. Cunningham, R. J. Beaver, R. D. Robertson, and E. C. Edgar. Feb. 11, 1959. 100p. Contracts W-7405-eng-26 and AT(30-3)-278. $2.50 (OTS).

Stainless steel-base fuel elements of thin plate-type construction and containing a dispersion of enriched uranium dioxide have been successfully employed in powering the Army Package Power Reactor. This report is concerned with the stationary fuel component proposed for operation in the second core loading of the reactor. The essential features of the component engineered for radioactive service in pressurized water at 450°F are described. The underlying criteria which guided the design are presented. The technological factors, such as compatibility, corrosion resistance, and irradiation behavior, which led to the selection of UO_2 as the fissile compound, boron carbide as the burnable poison, and austenitic stainless steel as the cladding and matrix material are reviewed. The fabricational procedures developed and adopted for manufacturing the component are presented in detail. This includes incorporation of the UO_2 and B_4C into stainless steel compacts by powder-metallurgy techniques, methods of preparing composite fuel plates by roll cladding, and assembly and joining the thin plates into an integral unit by brazing with a nickel-base alloy. Quality-control measures adopted to consistently produce components within dimensional tolerances on a pilot-plant basis are described. The general requirements on the task of supplying a loading of Core II fuel elements are outlined for the purpose of informing prospective fabricators with the nature and scope of the undertaking. Detailed specifications on the material and dimensional requirements the manufacturer is expected to meet are also provided. (auth)

5957 ORNL-2657

Oak Ridge National Lab., Tenn.

MARITIME REACTOR PROJECT ANNUAL PROGRESS REPORT FOR PERIOD ENDING NOVEMBER 30, 1958. Feb. 5, 1959. 39p. Contract W-7405-eng-26. $1.25 (OTS).

In studies of hazards associated with the operation of the N. S. Savannah, estimates were made of the activity buildup to be expected in the primary cooling system, the coolant purification system, and the waste disposal system. Evaluations of the relative importance of corrosion-product and recoil activities indicated, as was expected, that corrosion-product activity is dominant in pressurized-water reactor systems. The possibility of an ozone explosion in the liquid-nitrogen-cooled charcoal adsorbers of the gaseous waste collection system was examined. Similarly the potential hazard of a hydrogen explosion was evaluated. Specific criteria for the containment vessel for the N. S. Savannah reactor were developed. A limited study is under way in an attempt to develop an optimum waste disposal procedure to be used on nuclear merchant ships of the N. S. Savannah type. Both dockside and sea disposal of the demineralizer resins, radioactive gases, and other radioactive wastes are being studied. Procedures to be followed to provide effective radioactive protection for the passengers, crew, and any other persons associated with the operation and maintenance of the vessel are being developed. A pressurized-water in-pile test loop is being designed and constructed that will be operated in the Oak Ridge Research Reactor. Metallurgical studies made in the evaluation and testing of reference design components for the first core of the N. S. Savannah are reported. Experiments were conducted with both Nicrobraz No. 50 and electroless nickel as brazing alloys for joining fuel element tubes and ferrules. Electroless nickel offers advantages in terms of preplacement of the brazing alloy. Neither alloy appears to have a deleterious effect on the type 304 stainless steel base metal. Welding studies have indicated that welds free from defects can be prepared with either cup-type or plug-type end closures. These joints can be radiographically inspected for porosity and lack of fusion on a 100% basis by making three exposures of each weld. Two methods of incorporating the burnable poison, boron, into the fuel elements have been examined. The reference method of using wrought boron-containing stainless steel tubing has the disadvantage that boron losses occur when brazing in hydrogen atmospheres at temperatures above 1010°C. These losses can be avoided by brazing in vacuum or argon. Attempts to incorporate boron into UO_2 either as ZrB_2 or as a controlled impurity met with little success. Development studies of pyrometer wires for monitoring the temperature of UO_2 pellets during irradiation are described. Studies of the use of metal heat transfer bonds to replace helium in the fuel elements in future cores of the N. S. Savannah are in progress. Calculations of the fine flux variations across fuel tubes, across fuel element cans, near control rods, and near control rod followers obtained thus far are presented. Also a two-group, two-dimensional study of the power distribution in the core for various control rod configurations is being undertaken. Some results are presented for the design core at the operating temperature. The results indicate that the control rods have a relatively localized effect on power distribution and that severe power peaking may occur for particular control rod configurations. (T.R.H.)

5958 PRDC-TR-16
Power Reactor Development Co., Detroit.
MONTHLY TECHNICAL REPORT FOR OCTOBER 1958 52p. Contract AT(11-1)-476. $9.30(ph OTS); $3.60 (mf OTS).

Meltdown studies were initiated on specimens of interest as reactor fuel alloys. Reports are included from an environmental radioactivity survey. The design and fabrication status of major reactor components is shown in chart form. Nuclear engineering studies and test procedures connected with installation of the various components are outlined. (For preceding period see PRDC-TR-15.) (C.H.)

5959 WAPD-MRP-77
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
PRESSURIZED WATER REACTOR (PWR) PROJECT TECHNICAL PROGRESS REPORT FOR THE PERIOD OCTOBER 24, 1958 TO DECEMBER 23, 1958. 76p. Contract AT-11-1-GEN-14. $2.00(OTS).

The design of the Seed 2 clusters which will be instrumented to monitor fuel plate temperature and the design of the mating control rod shrouds have been modified to simplify fabrication, improve rigidity, and eliminate fretting. Several alternate Seed 2 metal and inlet water temperature thermocouple terminal box designs were developed. Analysis of the blanket cluster indicated a severe pressure loading on the cluster that required a major design change. Limitations imposed on the number and locations of places that instrumentation tubing can be carried through the flange are setting a pattern for flange penetrations. The stress relaxation properties of Zircaloy-2 in the beta-quenched dead annealed and as-welded conditions have been determined. Fission gas release from 80 mil thick UO_2 plates exposed at 702,000 Btu/hr-ft^2 to 10,250 Mwd/t was found to be 0.23% based on krypton-85 determinations. Tensile testing of modified Zircaloy tensile specimens exposed in an in-pile hot water loop indicated that the ductility of nickel diffusion bonded specimens was sharply reduced as the nickel content increased, that the ductility of copper and iron diffusion bonded specimens was reduced approximately the same amount as normal Zircaloy, and that the ductility of normal Zircaloy-2 and nickel free Zircaloy-2 specimens was not significantly different. Examination of the defected and water-logged compartmented plate fuel element (CR-X-1-0 test) showed the original defect to be blocked and small hairline cracks existing in the cladding of the swollen compartment. Improved quality bonds displaying reduced bond-line porosity and high bend strength have been achieved in copper-diffusion-bonded PWR Core 2 oxide plate fuel elements with improved copper plating and vacuum sealing techniques. Chemical analyses of the cladding as a function of distance from the exposed surface of copper-diffusion-bonded fuel elements indicates that uranium diffusion (from the contained UO_2 fuel) is restricted to a few mils and does not present a surface contamination problem. Examination of lumped burnable poison plates after irradiation in NaK capsules indicates that 2 wt. % B^{10} stainless steel (18 Cr–15 Ni–Fe) alloy is a very promising material. No adverse effects were noted after up to 70% burnup of the B^{10} atoms with thickness increasing from 0.030 to 0.033 in. The investigation of a protective metallic coating for Ag–15 In–5Cd alternate control rod material was successfully completed. Tests in dynamic oxygenated water at 550°F indicate that the coating is quite effective in protecting the base alloy during severe oxygen. Single phase solid solutions of ZrO_2–UO_2 which are corrosion resistant to high temperature, high pH water were fabricated. Results of an isothermal compressional stress gradient test on Zircaloy-2 containing dissolved hydrogen showed a definite redistribution of hydrogen toward the region of maximum stress. A two-dimensional depletion study of PWR-1 has been carried through the reactivity life of Seed 1. The data thus obtained are being used to reevaluate the reactivity life of Seed 1, and also as the basis for a series of three-dimensional synthesis studies to determine the power distribution in the core at various times in life. The effect of the local non-uniform depletion of fuel in a seed cluster on the estimated reactivity life on PWR-1 has been found to be negligible. The two-dimensional depletion calculation of a PWR-2 seed subassembly having two distinct zones of fuel has been completed. For the case studied, the local power peak-to-average ratio increased with time by about 10 percent of its initial value. However, the maximum value attained was still 20 percent below the value existing at beginning-of-life when no fuel redistribution was utilized. A study to determine the effect of blanket resonance escape probability on seed-blanket power sharing during long-term irradiation has been completed. Activation measurements of the neutron flux distribution in localized regions of the PWR mock-ups are providing evidence that the use of present analytic techniques to calculate the local water channel power peaking factors in seed and blanket results in underestimates of those factors. A method for modifying the present technique to provide more realistic values for the peaking factors is being developed. (For preceding period see WAPD-MRP-76.) (auth)

5960 WAPD-PWR-TE-34
Westinghouse Electric Corp. Bettis Atomic Power Div., Pittsburgh.
PRELIMINARY SHIPPINGPORT PWR PHYSICS TEST RESULTS AFTER 1690 EQUIVALENT FULL POWER HOURS. Test Evaluation DL-S-149, Section I and II; DL-S-151, Section I; and DL-S-156, Section I. Test Dates: September 4-7, 1958. R. P. Christman. Oct. 30, 1958. 11p. $3.30(ph OTS); $2.40(mf OTS).

The results are given of most recent measurements (November 1958) in PWR of excess reactivity at ambient and operating temperatures, temperature reactivity defect, temperature coefficient of reactivity, and the reactivity effect of the Xe transient. Earlier measurements are given for comparison. (T.R.H.)

5961 YAEC-112
Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.
MONTHLY PROGRESS REPORT FOR THE PERIOD DECEMBER 1 TO 31, 1958. R. W. Garbe and H. E. Walchli. Jan. 20, 1959. 18p. For Yankee Atomic Electric Co. Contract AT(30-3)-222, Subcontract No. 1. $3.30(ph OTS); $2.40(mf OTS).

The status of various research and development projects is briefly summarized. (For preceding period see YAEC-103.) (W.D.M.)

5962 AEC-tr-3537
THE WAY TO AN ATOMIC AIRCRAFT. (Na Puti k Atomnomu Samoletu.) G. I. Pokrovskii (Pokrovskiy). Translated from Sovet. Aviatsiya, No. 152, June 29, 1957, p.2. 3p. $1.80(ph); $1.80(mf) JCL or LC.

A discussion of the design of a nuclear-powered aircraft is presented. Crew protection is most important, and a design is presented to place the crew as far as possible from the reactor and to locate mass, such as normal aircraft mechanisms, between crew and reactor instead of a screen to serve solely as crew protection. Other methods of separation of people from the reactor vicinity are discussed, such as teleguided glider tow aircraft and the use of remotely controlled freight planes. (J.R.D.)

5963

DESIGN, SKETCH, AND TECHNICAL PROBLEMS OF A PRESSURIZED WATER REACTOR FOR A TANKER OF 10,000 SHP. K. Illies. Atomkernenergie 3, 473-9(1958) Dec. (In German)

A survey is presented of a 10,000-SHP tanker propulsion plant; it is a continuation of investigations commenced in 1955 at the Lehrstuhl für Schiffsmaschinenbau (Institute for Marine Engineering) at the Technische Hochschule, Hannover. Problems and proposals for their solution are discussed; main data of the amended plant are compared with those of the original one. Some ways for further work on these problems are pointed out. (auth)

5964

REACTOR LAYOUT AND CONSTRUCTION FOR A PRESSURIZED WATER NUCLEAR POWER PLANT FOR A SHIP. A. Mareske. Atomkernenergie 3, 480-4(1958) Dec. (In German)

An outline is given of the special problems connected with the design of a reactor core for a PWR ship propulsion plant. Core design and fuel element forms and their heterogeneous lattice are discussed. For the application of fuel elements in the form of tubes some derivations are given for the computation of thermal utilization and resonance escape probability in the microscopic reactor theory. (auth)

5965

TEMPERATURE DISTRIBUTION IN THE CORE OF A PRESSURIZED WATER REACTOR AND ITS EFFECT ON NUCLEAR GEOMETRY. H.-G. Bachmann. Atomkernenergie 3, 484-5(1958) Dec. (In German)

The main variables of core geometry influencing the temperature distribution in a PWR-core are discussed, with special consideration of annular fuel elements. (auth)

5966

DESIGN POSSIBILITIES AND CONSTRUCTION OF CONTROL INSTALLATION FOR PRESSURIZED WATER REACTORS. H. Schafstall. Atomkernenergie 3, 486-9(1958) Dec. (In German)

The principal demands of reactor control equipment for ship reactors are discussed. Some possibilities of reactor control and drive mechanisms are described. Two proposals are made for the practical design of a control gear for pressurized water reactors. (auth)

5967

TEMPERATURE AND STRESS DISTRIBUTION IN REACTOR PRESSURE VESSELS. H. Daldrup. Atomkernenergie 3, 489-92(1958) Dec. (In German)

The heat and thermal stresses produced by γ radiation and neutron reactions in reactor pressure vessels were analyzed for different heat sources, thickness of walls, and temperatures at the surfaces of the pressure vessel. From the curves of temperatures and stresses, estimates are made about the selection of materials for the reactor pressure vessel. (auth)

5968

PRE-DETERMINED FACTORS FOR SIZE AND WEIGHT OF THE RADIATION SHIELDING OF A SHIP'S PRESSURIZED WATER REACTOR PLANT. K. Schleifenheimer. Atomkernenergie 3, 492-8(1958) Dec. (In German)

The effects of power output and layout data upon shield weight for a typical water-cooled reactor suitable for shipboard installation are considered. The decrease in weight produced by suitable distribution of neutron and gamma shielding is calculated for this specific case. A short description is given of the activity of the reactor coolant (both intrinsic and impurity activity from corrosion products in the coolant stream). The values of water activity for the projected PWR plant are calculated. Finally, the most expedient arrangement of the coolant shield is discussed. Instead of separately shielding the coolant pipes, valves, and heat exchangers, it was found advantageous to use a compartment shield fixed on the spherical safety container which entirely encloses the partially shielded reactor and the whole primary loop-system. (auth)

5969

LAYOUT AND CONSTRUCTION OF SATURATED STEAM TURBINES. Fritz Schmiedel. Atomkernenergie 3, 498-504(1958) Dec. (In German)

Low temperatures in pressurized water reactors are the reasons that in such plants saturated steam turbines are usually installed. The possibility of producing superheated steam in reactor plants is critically examined. The decrease of efficiency by saturated steam, the kind of turbine construction, the expansion in the wet steam sphere, and the separation of water are discussed. For pressures between 10 and 50 kg/cm^2 and for different steam flows the efficiencies are compared. Also the increase of efficiency by lowering the pressure at constant temperatures (coming into the sphere of superheated steam) are examined. Finally, some aspects about construction of saturated steam turbines are shown. (auth)

5970

CALCULATION AND CONSTRUCTION OF THE PRESSURIZED WATER–SATURATED STEAM HEAT EXCHANGERS. G. Heldt. Atomkernenergie 3, 504-9 (1958) Dec. (In German)

A discussion is given of the influences of interior and exterior heat transfer and heat conductivity in tube heat exchangers working with pressurized water inside and boiling water outside tubes. The difficulties in evaluating heat transfer rates to boiling water and the various influences on these data are discussed. For an approximate computation a plot is given based on the main variables influencing this system of heat transfer calculation. Furthermore, some new designs of heat exchangers are described. (auth)

5971

PROBLEMS ON THE INDUSTRIAL MATERIALS, MANUFACTURE, AND CONSTRUCTION OF HEAT EXCHANGERS FOR NUCLEAR ENERGY PLANTS. E. Karlsen. Atomkernenergie 3, 510-12(1958) Dec. (In German)

With the aid of a conventional heat exchanger of small capacity, problems of corrosion and fabrication are discussed. Possibilities of solving the additional problems of design of large capacities are reported, and a new development is compared with an orthodox design. (auth)

5972

A GAS COOLED NUCLEAR REACTOR OF HIGH THERMAL EFFICIENCY. F. Winterberg. Atomkernenergie 4, 2-6(1959) Jan. (In German)

It is shown that the thermal efficiency of a gas-cooled reactor with gas turbines can be increased by isothermal expansion of the coolant in appropriate cooling channels of variable cross section in the reactor core. To optimize further the efficiency of the cooling, it is desirable to hold the temperature of the fuel constant. Under this condition the cooling channel cross section, the streaming velocity of the coolant, and the heat source distribution are calculated. (auth)

5973

HEAT ENGINEERING CALCULATIONS OF A GAS COOLED REACTOR. Hans Dieter Baehr (Univ. of Berlin). Atomkernenergie 4, 7-11(1959) Jan. (In German)

As gases are bad heat transfer media, the design of the cooling system is of special importance for gas-cooled nuclear reactors. The maximum permissible surface temperature of the fuel elements and the available pumping power set a limit for the gas temperatures and the reactor power. The equations governing the relations between power, gas temperatures, pressure drop, and pumping power for a single channel are presented graphically in a diagram. By means of this diagram various possibilities for the gas distribution to the cooling channels can be examined. It is shown how the economic optimum of the pumping power can be found which makes the cost of the kwh produced a minimum. This optimum must, in general, be found by trial and error with the aid of the "channel-characteristic." For a special gas distribution an analytical solution is given. Finally, the example of a reactor cooled by high-pressure gas is presented. (auth)

5974

SUPPLEMENT TO THE CALCULATION OF THE COOLING EFFICIENCY OF REACTOR COOLANT CHANNELS. H. Benzler (Deutschen Babcock and Wilcox Dampfkesselwerke AG, Oberhausen, Ger.). Atomkernenergie 4, 12-13(1959) Jan. (In German)

The cooling efficiency of reactor channels is calculated by three different equations. In the first case the maximum fuel element surface temperature is at channel inlet. The second equation refers to maximum temperature at the outlet, and in the third case the highest surface temperature is between these two extremes. (auth)

5975

THERMAL CAPACITY IN REACTORS. M. Ledinegg. Atomkernenergie 4, 14-22(1959) Jan. (In German)

The object of the study was to determine the highest thermal capacity of reactors. One of the most important limits for gas and liquid cooled reactors is the highest temperature inside the fuel elements. Some other factors are considered. A relation for the highest thermal capacity is deduced, and the best possible values for the dimensions with regard to minimum work of the circulation pumps are accounted. Other possibilities for its reduction, like radial and axial variation of the cross section of the cooling channels, are thoroughly examined. (auth)

5976

NEUTRON STUDY OF THE G-2 AND G-3. A. Teste du Bailler. Bull. inform. sci. et tech. No. 20, 1-9(1958) Aug. (In French)

The essential characteristics, as well as the principal numerical values, of the natural uranium–graphite matrix of the G-2 reactor are given. The calculation methods and the formulas used are not reproduced. The reactivity control and the flattening of the flux curve are briefly considered. (J.S.R.)

5977

THERMODYNAMIC STUDY OF THE G-2 AND G-3. J. Chaboseau and P. Laferrière. Bull. inform. sci. et tech. No. 20, 10-27(1958) Aug. (In French)

A thermodynamic study of the G-2 and G-3 reactors must consider the plutonium generation function of the reactors and the recovery of thermal energy in a power plant with as good a yield as possible. The formulas used for the calculation of heat transfer and charge loss are derived. The conditions for the start-up of the reactors are determined. A study was made of the cooling of the reactors in the case of the flattening of the radial flux curve. (J.S.R.)

5978

THE CORE OF THE G-2 AND G-3 REACTORS. G. Deleuze. Bull. inform. sci. et tech. No. 20, 36-55 (1958) Aug. (In French)

All parts of the reactor contained within the concrete shield are described in detail. The graphite block, the wall of graphite protecting the rear face, the thermal shielding screen, the graphite supports, the bands for the graphite on its side and upper faces, the pressure supports of the graphite, the loading unit, the channels for fuel element discharge, the control and safety rods, the compartmentation of the coolant gas, and the installation of detection and measurement instruments are discussed. The protection of the metallic parts of the core from corrosion is briefly considered. (J.S.R.)

5979

CIVIL ENGINEERING OF THE PRESSURE VESSELS. J. Bellier and M. Tourasse. Bull. inform. sci. et tech. No. 20, 56-68(1958) Aug. (In French)

The pressure vessels of the reactors are the concrete shielding necessary for biological protection. To enable the concrete to withstand high pressures and stresses, concrete reinforced with steel cables is used. The advantages of the reinforcing and the general arrangement of the cables are discussed. A description of the pressure vessel construction and fabrication of the cables is given. The calculations made on the pressure vessels and the cables are reported. (J.S.R.)

5980

LOADING AND UNLOADING. A. Ertaud and G. Derome. Bull. inform. sci. et tech. No. 20, 69-88(1958) Aug. (In French)

The loading and unloading system of the G-2 and G-3 reactors consists essentially of a mobile loading device, a lattice of inclined drains and pipes which collects the irradiated fuel elements, and telecommanded workshops which group the fuel elements and transport them to the pool. Each of these parts is considered in detail. (J.S.R.)

5981

THE COOLANT CIRCUITS. J. Chaboseau and P. Laferrière. Bull. inform. sci. et tech. No. 20, 89-98(1958) Aug. (In French)

A schematic diagram of the coolant circuits of the reactors is presented. The principal primary circuit and the auxiliary primary circuit are discussed in detail. The secondary circuit, compensation circuit, and the separation valves are considered more briefly. (J.S.R.)

5982
INSTALLATIONS FOR ENERGY RECOVERY. P. Passérieux and R. Scalliet. Bull. inform. sci. et tech. No. 20, 99-114(1958) Aug. (In French)

The general characteristics of the water–steam circuits and of the electrical circuits are tabulated, and the layout of the installations for energy recovery is sketched. The installation for energy recovery has as its first function the proper cooling of the reactor under all conditions, and only secondarily the production of electricity. The means taken to ensure this operation are outlined. The heat exchangers, turbines, condensers, overheating regulators, the control apparatus, and the pumps are described in detail. (J.S.R.)

5983
TREATMENT OF THE FLUID. P. Dequènes and M. Garnier. Bull. inform. sci. et tech. No. 20, 115-25 (1958) Aug. (In French)

The carbon dioxide is treated before its introduction into the reactor, during its storage, just before feeding into the reactor, during its circulation by continuous purification, and at the moment of its evacuation to the atmosphere by venting. The methods used at each stage are described. (J.S.R.)

5984
CONTROL OF THE G-2 AND G-3 REACTORS. A. Ertaud and A. Pagès. Bull. inform. sci. et tech. No. 20, 126-39(1958) Aug. (In French)

A brief description is given of the ensemble of mechanisms which permits control of the reactor, gives information to the personnel in charge of the reactor operation, and monitors the safety of the personnel and materials. (J.S.R.)

5985
ELECTRO-MECHANICAL INSTALLATIONS. M. Lignières, J. Bobigeat, and A. Darré. Bull. inform. sci. et tech. No. 20, 140-51(1958) Aug. (In French)

The principles at the basis of the studies on the operation and control and the electromechanical devices of the G-2 and G-3 reactors and the power station are reviewed. (J.S.R.)

5986
POWER REACTORS: COMPARISON OF SEVERAL TYPES. Arnaldo M. Angelini. pp. 95-112 in "Atti del Congresso Scientifico. Volume I. Sezione Nucleare, Giugno 1957." (In Italian)

The criteria for comparing various types of power reactors are cost of the energy produced, power limits, problems of safety, fuel cycle, results of the technical difficulties of the plant, and the operating costs. Each of these is briefly discussed. The prospects for the construction of a nuclear power plant in Italy are indicated. (J.S.R.)

5987
REACTORS OF THE UNITED KINGDOM PROGRAMME. R. R. Gallie (United Kingdom Atomic Energy Industrial Group H. Q., Risley, Lancs, Eng.). pp. 113-126 in "Atti del Congresso Scientifico. Volume I. Sezione Nucleare, Giugno 1957."

A brief survey is made of the United Kingdom nuclear power program. The Calder Hall Reactors and the industrial reactors based on this design are described. The possibilities of future development of the Calder Hall design to reduce the cost of electricity are considered. Other thermal reactors in the British program are briefly discussed. The fast breeder reactor is being studied. (J.S.R.)

5988
THE REACTORS OF THE FRENCH PROGRAM. Jules Horowitz (Commissariat a l'Energie Atomique, Paris). pp. 127-38 in "Atti del Congresso Scientifico. Volume I. Sezione Nucleare, Giugno 1957." (In French)

The reactors of the French nuclear power program include G-1, G-2, G-3, and EDF-1, and each is discussed. Some prototypes which are being planned are briefly described. (J.S.R.)

5989
ENRICHED URANIUM REACTORS. Nelson F. Sievering, Jr. (U. S. Atomic Energy Commission, Washington). pp. 163-76 in "Atti del Congresso Scientifico. Volume I. Sezione Nucleare, Giugno 1957."

An attempt is made to enumerate some of the advantages of enriched fuels to point out the interrelationships of fuel and reactor and to outline some of the short-term and long-range developments in enriched reactors that may influence a large nuclear power program. (J.S.R.)

STABLE ISOTOPE SEPARATION

5990 NYO-208
Girdler Corp. Gas Processes Div., Louisville, Ky. ENGINEERING AND LABORATORY STUDIES—POLYMER PROJECT. (PRODUCTION FACILITIES FOR BORON 10.) Apr. 3, 1953. Decl. Apr. 25, 1958. 161p., 2 illus. Contract AT(30-1)-1506. $28.80(ph OTS); $8.40(mf OTS).

Contains Process Development and Research Labs. Reports: T8.10-1-1; T9.35.0-1-1; T1.25-4-1; 79.44-1-1; T8.10-1-2; T9.40-2-1.

Cost estimates and design, engineering, procurement, and construction of plants to produce B^{10} in quantities of 500 and 750 kilograms per year in concentrations of 70% and 95% are presented. Process designs and plant layouts were made for methyl ether–boron trifluoride complex preparation and fractionation and for the production of pulverized crystalline boron fractionated complex. Laboratory studies were carried out on the thermal degradation of methyl ether–boron trifluoride complex and on the effect of methyl fluoride recirculation through the fractionation. Other studies included dehydration of methyl ether and corrosion tests with the complex on pump and packing materials. (W.L.H.)

5991
ELECTROMAGNETIC SEPARATION OF THE PLATINUM ISOTOPES. V. M. Gusev. Atomnaya Energ. 5, 641-2(1958). (In Russian)

Descriptions are given of ionic sources for use at temperatures up to 2800°C which were used for separating platinum isotopes. The work was accomplished in two cycles, the first cycle included isotopes Pt^{190}, Pt^{192}, Pt^{194}, Pt^{196}, and Pt^{198}, and the second included isotopes Pt^{190}, Pt^{192}, Pt^{195}, and Pt^{198}. In the first cycle, Pt^{195} and Pt^{196} were scattered on the bridge of the receiver graphite membrane. Mass spectroscopic analysis of enriched isotopes was performed. Tabulated results are compared to the results obtained at Oak Ridge National Laboratory. The ion source was also used for the separation of ruthenium and in the preparation of Ir and Os isotopes for the Geneva Exhibit in 1958. (R.V.J.)

TECHNOLOGY

Raw Materials

5992 AECU-4001

Bureau of Mines. Intermountain Experiment Station, Salt Lake City.

PROCESSING OF THE GOLDEN CYCLE BLEND OF COLORADO FRONT RANGE URANIUM ORES. I. L. Nichols, J. R. Ross, K. E. Tame, and J. B. Rosenbaum. Jan. 1959. 25p. (RR-53.1). $4.80(ph OTS); $2.70(mf OTS).

Laboratory and pilot plant research to appraise the technical and economic feasibility of processing the Golden Blend of Colorado Front Range Ores is described. (T.R.H.)